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of the

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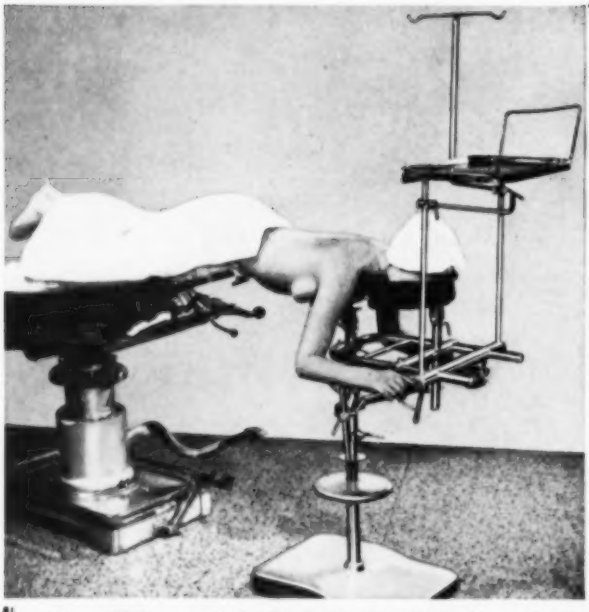

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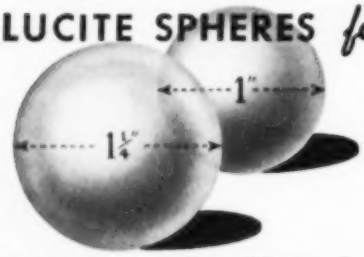

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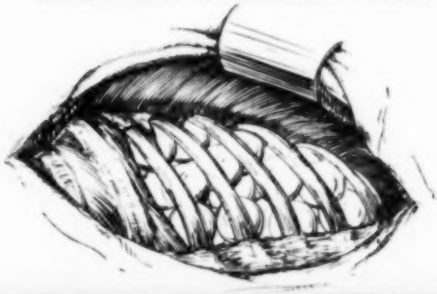

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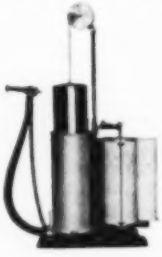

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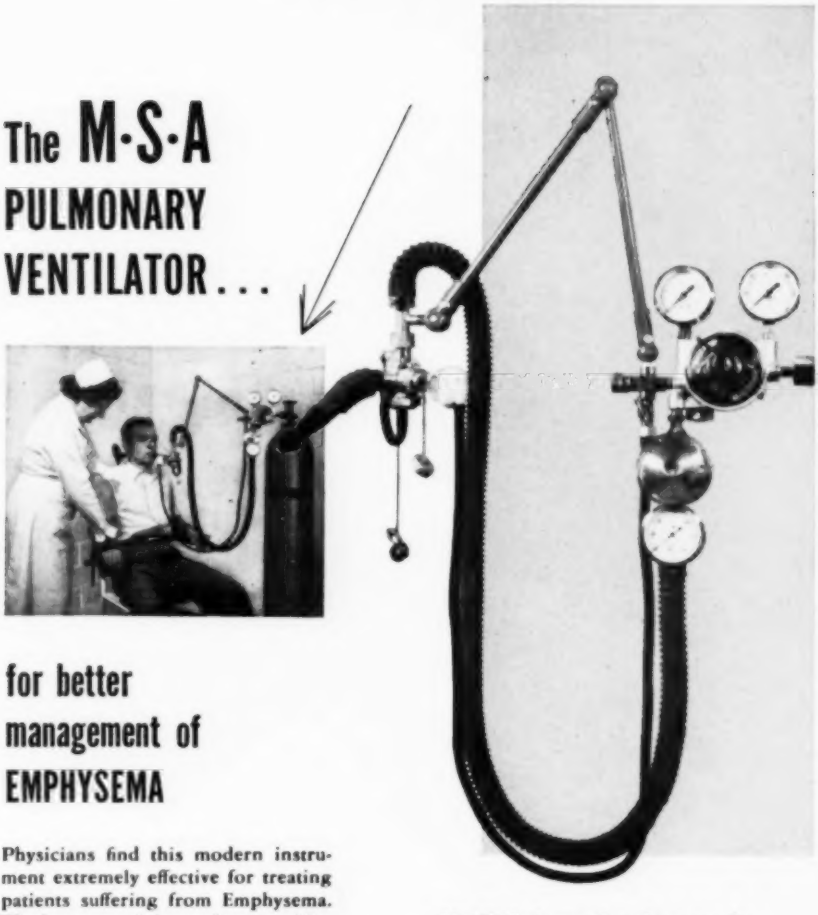

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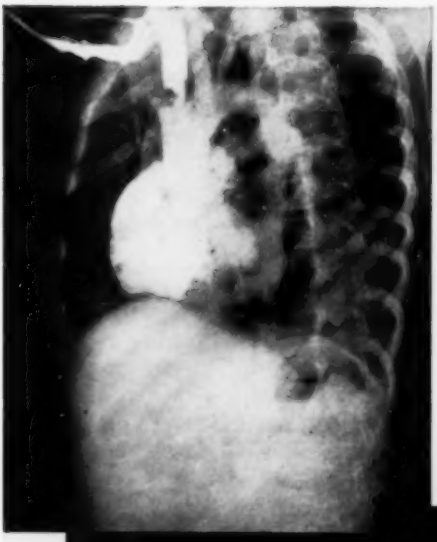

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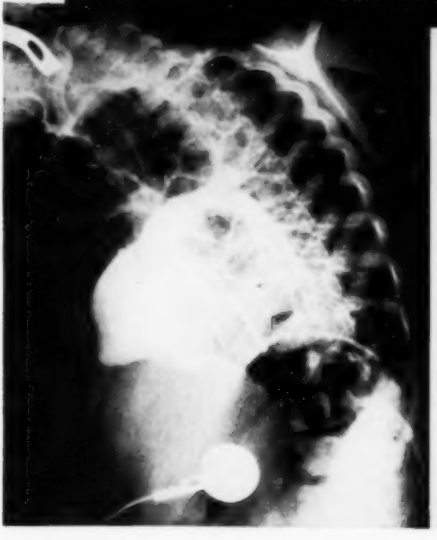

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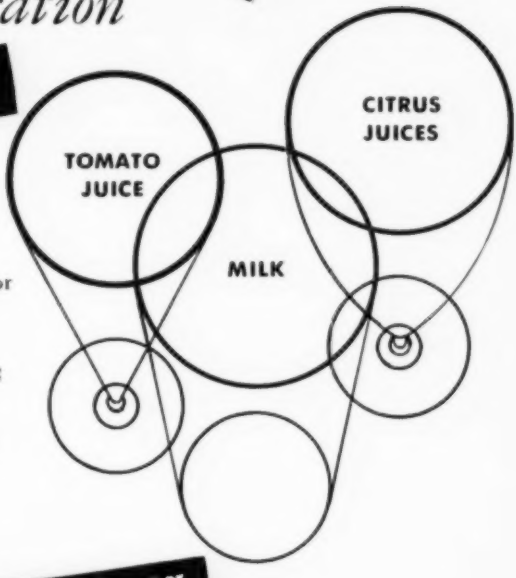

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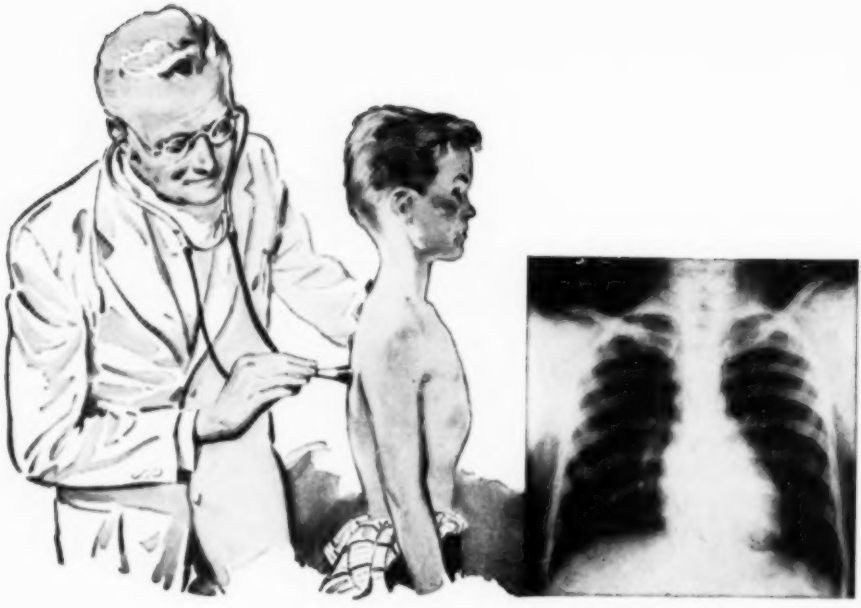

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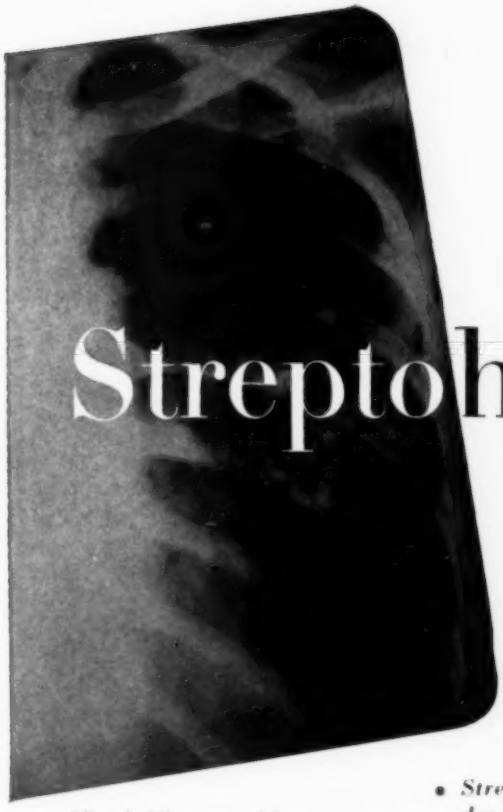

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References: (1) Segal, M. S.: Springfield, Charles C. Thomas, 1950, p. 83; (2) Barach, A. L.: J.A.M.A. 147: 730-737, 1951; (3) Segal, M. S., et al.: Ann. Allergy 9: 782-793, 1951; (4) Bickerman, H. G., and Beck, G.: Personal Communication.

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1. Kaufman and Farmer (1951), Ann. Allergy, 9:89, January-February
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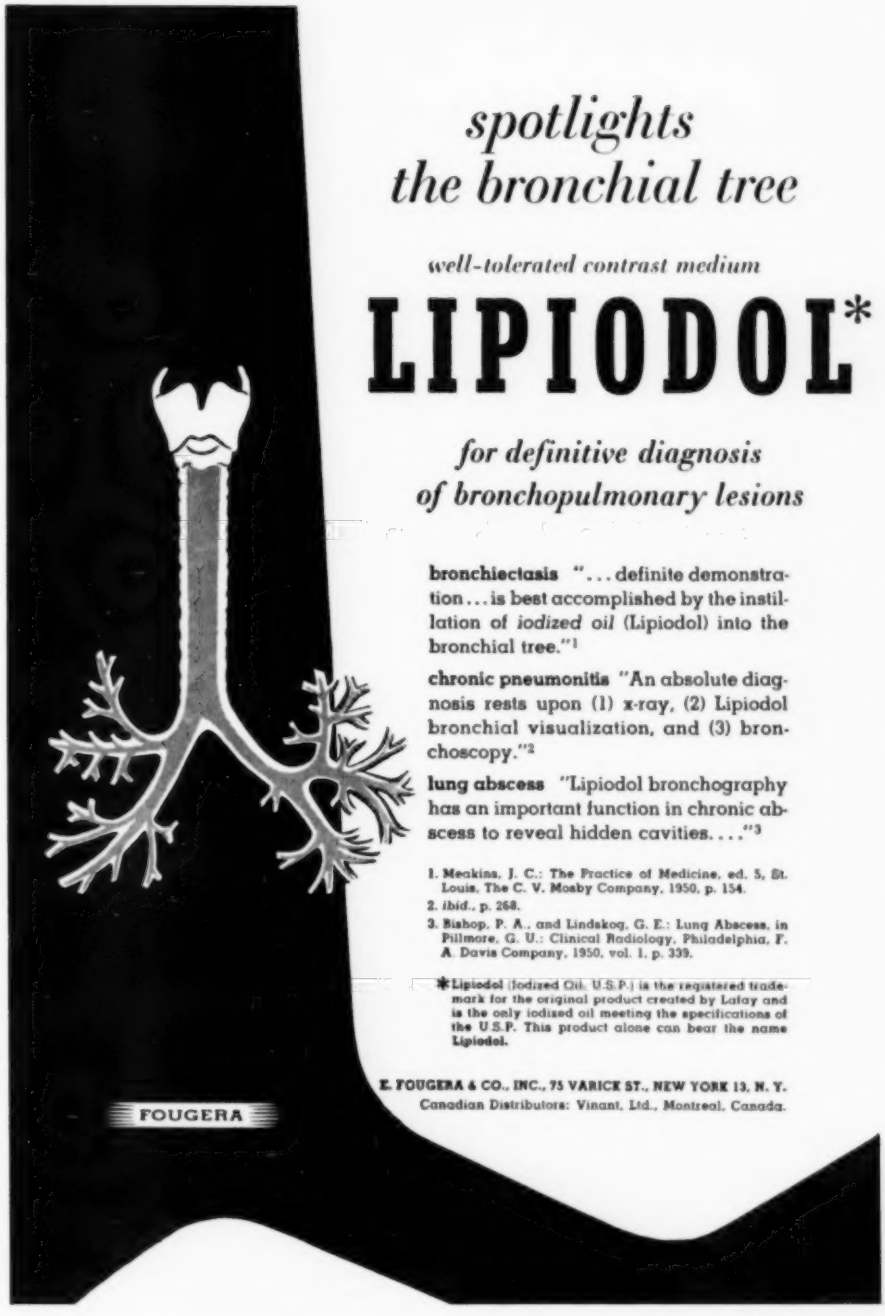

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2. *ibid.*, p. 268.
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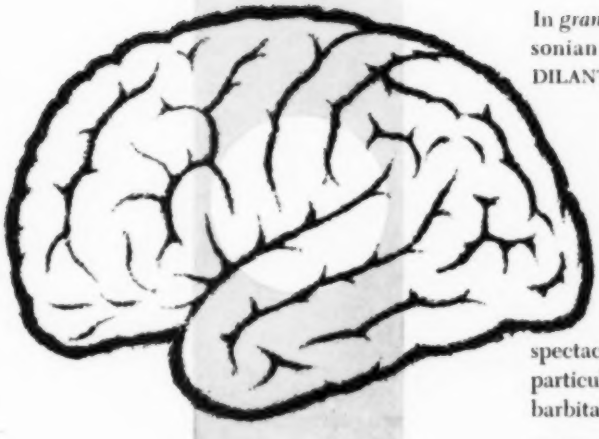

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DISEASES *of the* CHEST

VOLUME XXIII MAY 1953 NUMBER 5

The Diagnosis of Cardiospasm*

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Rochester, Minnesota

During the 12 year period extending from January 1, 1935, through December 31, 1946, 601 patients with cardiospasm were seen and treated at the Mayo Clinic. This number does not include any patients first seen and treated prior to 1935, who may have returned during the period under consideration. The results of treatment with hydrostatic dilatation on 452 traced patients have been reported recently.[1] Considerable information concerning the clinical features of cardiospasm was derived in the course of that study and will be recorded in the present paper. The pulmonary complications of cardiospasm have been considered in a separate communication.[2]

Cardiospasm may be defined as nonorganic stenosis of the lowermost portion of the esophagus. Narrowing usually extends for a distance of not more than 4 to 6 cm. above the esophagogastric junction. Cardiospasm is not an ideal name for this condition, and a number of other terms have been employed which, for the most part, reflect the varied concepts of etiology. Achalasia, preventriculosis, phrenospasm, mega-esophagus and esophagectasia are some of these names. The continued use of cardiospasm can be justified only by precedence. It is important to emphasize that the cardiospasm or achalasia which we are referring to is a disturbance of the physiologic sphincter at the cardia. This condition must be distinguished from esophageal spasm and from intermittent spasm at the cardia. Exactness of diagnosis is most important, especially for the selection of treatment and prognosis.

The Literature

The literature on cardiospasm is extensive and any effort to review it would have little merit in this paper. Students of the subject should refer to the communications of Thieding[3] and Sturtevant[4] for reviews of the early literature. Hurst[5] has made many contributions to our knowledge of this disease which he aptly described as achalasia of the cardia. An excel-

*Presented at the meeting of the American College of Chest Physicians, Chicago, Illinois, June 5, 1952.
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lent summary of his opinions appeared in 1934.[5] The studies of Etzel,[6,7] Lendrum,[8] Kramer and Ingelfinger,[9-11] Womack and associates,[12] Templeton,[13] Johnstone and Woolen[14] have added much to our knowledge of the pathogenesis of this condition. The many contributions to the treatment of cardiospasm were considered in a recent paper by Olsen, Harrington, Moersch and Andersen.[1]

The previous experience of the Mayo Clinic with cardiospasm has been recorded in a number of communications. Plummer[15] reported 11 cases in 1906, and his papers brought the condition to the attention of the medical profession in North America. He made many observations on the nature of cardiospasm and its diagnosis and treatment. In 1921, Plummer and Vinson[16] reported on accumulated experience with 301 cases, and in 1924, Vinson[17] increased the series to 415. In 1933, Moersch[18] discussed the diagnosis and treatment based on 810 cases of cardiospasm.

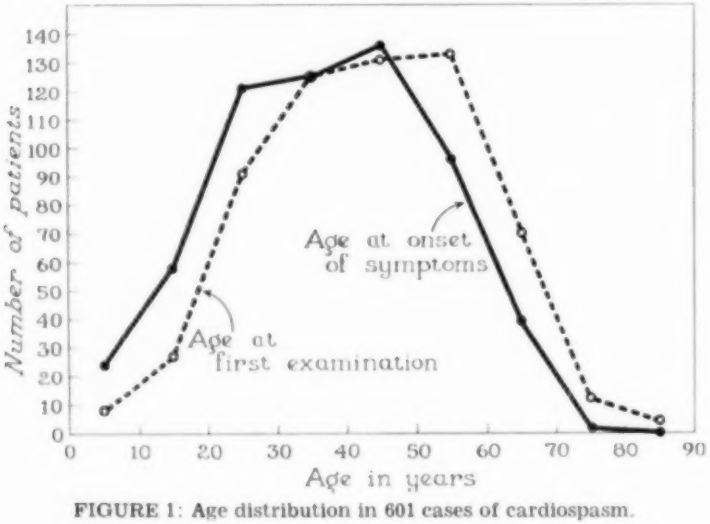

FIGURE 1: Age distribution in 601 cases of cardiospasm.

TABLE I

CORRELATION OF SIZE OF ESOPHAGUS AND DURATION OF SYMPTOMS IN 452 CASES

Stage	Degree of Enlargement of Esophagus	DURATION OF SYMPTOMS (YEARS) Less than 1	1-5	6-10	More than 10	Total
1	Slight	27	16	7	5	55
2*	Moderate	32	119	31	18	200
3*	Diffuse	16	50	30	31	127
4*	Marked with angulation	3	27	15	25	70
	TOTAL	78	212	83	79	452

*Stages 2, 3 and 4 are illustrated in figures 2a, 2b and 2c.

Clinical Data

In all 601 cases in our series cardiospasm was the primary condition.

Sex and Age: There were 327 males and 274 females in the group. A careful tabulation of the ages of all traced patients was made not only at the age when they had the initial symptoms but also when they consulted the Mayo Clinic. This information is recorded in Figure 1. Cardiospasm occurs at all ages but is seen most frequently in middle life. The youngest patient was only two years of age and the oldest was 88. Data concerning the duration of symptoms is given in Table I.

Symptoms: The earliest and most constant symptom of cardiospasm is obstruction to swallowing. In fact, practically all patients complain that food sticks on its way to the stomach. At first dysphagia is intermittent, but as the condition progresses, difficulty is experienced with all efforts to swallow. The patient usually indicates that obstruction is low in the substernal or subxiphoid region. However, the sensation of stoppage may be referred to the cricoid region. As a rule, the patient experiences more difficulty with cold than with warm foods and on many occasions he will relate that solid foods pass more readily than liquids. However, the symptoms of obstruction vary greatly from patient to patient and no exact pattern can be described.

Regurgitation is the next most common symptom of cardiospasm. This symptom is not frequent in the early phases of the disease, but as the esophagus becomes dilated and distended with food, eructation becomes common. More than 60 per cent of our patients mentioned regurgitation. The earliest sign of regurgitation may be the soiling of the pillow slip during sleep. Later substantial portions of the ingested food may be regurgitated at varying intervals after meals. Usually the patient brings up food, recently eaten, that is not acid to the taste. When cardiospasm is of long standing, the vomitus may consist of food eaten many hours previously.

Many patients wilfully regurgitate esophageal contents in order to relieve themselves of the discomfort of distended esophagus. Not infrequently patients acquire certain eating habits which enable a greater amount of nourishment to reach the stomach. At times ingestion of large quantities of water with food will aid in overcoming resistance at the cardia. Some patients learn to execute certain maneuvers which will force food into the stomach. After taking a large swallow, the patient will hold his breath, strain and grunt with a closed glottis to increase intrathoracic pressure. If the cricoid sphincter is closed and the esophagus is distended with food and fluid, the resistance at the cardia may be overcome. Some patients stand or crouch forward when they swallow; often they hang onto a mantelpiece or some similar object. Such contortions are observed when cardiospasm is rather advanced.

Pain is a relatively infrequent symptom of cardiospasm. It occurred in only 29 per cent of our 601 cases. Pain is likely to occur in the early stages of the disease and may become less prominent as the esophagus dilates. The pain may be epigastric or substernal and occasionally may be referred

to the back or to the neck, jaws, shoulders or arms. Pain may be precipitated by drinking cold liquids. When present, pain is often severe and infrequently may simulate the pain of angina pectoris or gallbladder disease. At times drinking hot water may relieve pain.

Hemorrhage from the esophagus is a rare symptom of cardiospasm. It occurred in only 15 of our 601 cases (2.5 per cent). At times patients complain of hiccups or excess salivation. Dyspnea, coughing and wheezing indicate pulmonary complications of cardiospasm and will be considered in a separate communication. Obvious signs of vitamin deficiency were noted in only seven cases (1.2 per cent) in our series. One of these patients had pellagra and that case has been reported previously.[19] The other patients had cheilosis, sore tongue, peripheral neuritis or mental aberrations. Loss of weight is not a constant manifestation of cardiospasm. Many patients maintain or even increase their weight by ingesting large quantities of milk and soft foods.

Roentgenologic Aspects

Roentgenologic examination is the most important diagnostic procedure in cases of cardiospasm. Obviously, the diagnosis is based on the roentgenoscopic and roentgenographic appearance of an esophagus filled with opaque medium. The examination should include roentgenoscopic observation during the passage of swallows of barium through the esophagus, as well as a series of roentgenograms of the barium-filled esophagus.

The earliest roentgenologic signs of cardiospasm are those of obstruction at the cardia and slight dilatation of the esophagus above the obstruction. It is unlikely that cardiospasm is ever recognized roentgenologically until obstruction at the cardia is sufficient to prevent for a time a column of fluid several inches in height from passing through the orifice into the stomach.

The roentgenologist must first determine that obstruction is present at the cardia. He then must decide whether he is dealing with cardiospasm or some other obstructive process. This decision will depend on a number of roentgenoscopic observations; namely, (1) the outline of the constricted segment at the cardia, (2) the degree of obstruction at the cardia, (3) the extent of enlargement or dilatation of the esophagus above the constriction, (4) the length and course of the esophagus, (5) evidence of retained food and fluid within the esophagus, and (6) alterations in the muscular activity of the esophagus.

Cardiospasm is usually a progressive disease, and for the purposes of a roentgenologic description it is convenient to consider our cases in four stages or phases of development. Although all factors mentioned are important in evaluation of severity of cardiospasm, the classification is more conveniently based on the degree of dilatation since this factor is evident from examination of the roentgenograms. The degree of dilatation of the esophagus and the stage of development was determined in the 452 traced patients (Table I).

We are limiting our report of the roentgenologic aspects of cardiospasm

to the records of the 452 traced patients and are not including the entire group. Several reasons influenced us in this limitation; the most important factor was our desire to correlate the data reported herein with that in the paper on treatment presented in 1951.[1]

The importance of the peristaltic waves and other contractions in cardiospasm has been pointed out by Templeton,[13] Kramer and Ingelfinger[9,10] and Butin, Olsen and Moersch.[20] These studies lend support to the concept that the early stages of cardiospasm (stages 1 and 2) represent a compensated phase in which there is thickening of the musculature and increased, though ineffectual, muscular activity. In the period of decompensation (stages 3 and 4) the esophagus is virtually "silent," and progressive dilatation and subsequently elongation and angulation occur.

The stages of cardiospasm may be described as follows:

Stage 1. Slight Dilatation (55 Cases): In its earliest phase cardiospasm may be difficult to recognize. At this time roentgenoscopic examination with the patient in the upright position reveals little or no appreciable increase in the diameter of the esophagus and the roentgenograms are like those of a normal esophagus. The first swallow of a thin mixture of barium sulfate and water passes readily through the organ until the esophagogastric juncture is reached. Here the orifice may appear narrower than usual and some of the fluid is usually retained in the lower 5 or 10 cm. of the lumen for a short time. There is ordinarily no retained food or fluid before the examination. The degree of obstruction is slight and the esophagus is not elongated. Following ingestion of the opaque mixture there may be some increased muscular activity principally in the nature of a short succession of secondary peristaltic waves which may milk the barium upward in the esophagus unless the cardiac sphincter opens. At this stage it may be difficult to ascertain the nature of the obstruction.

Stage 2. Moderate Dilatation (200 Cases): As cardiospasm becomes more chronic, the classic roentgenologic signs develop (Figure 2a). The esophageal lumen, except for the diaphragmatic portion, is usually wider than normal. Retained food and fluid may be present in the lower portion of the esophagus but the opaque mixture being denser shifts downward to the lowermost part and is retained there. The lumen thus outlined appears to be conical and narrowed for a short distance with a beaklike extension directed into the spastic segment. This appearance was described by Carman[21] in 1920. Some increase in muscular activity may be evident which suggests ineffectual peristalsis. Seldom, however, does enough barium pass through the narrowed segment at the time of initial roentgenoscopic examination to permit adequate examination of the stomach. After a few minutes during which time roentgenograms of the barium-filled esophagus may be made, a moderate amount of the barium does enter the stomach. After the stomach is filled, roentgenoscopic examination may be repeated in order to view the cardia and fundus.

There is no uniformity of location for the moderately dilated segment of esophagus. Occasionally the upper half will be widened while the caliber of the lower half appears to be more nearly normal; possibly the reason

is that muscular activity is apt to be more marked in the lower portion after a swallow of opaque medium. In other cases, especially those in which obstruction at the cardia is more chronic or there is beginning decompensation (stage 3) the greatest dilatation may be evident in the lower segment.

Stage 3. Diffuse Dilatation (127 Cases): When generalized or diffuse dilatation has occurred (Figure 2b), the presence of cardiospasm is readily suggested on roentgenoscopic examination. There is usually a fairly long column of retained food and fluid in the esophagus through which the mixture of barium and water drifts downward toward the cardia. The classic roentgenologic signs are then demonstrated, for the dilated segment abruptly terminates in a short, tapered segment, smooth in outline which ends in a short point or beak. Occasionally a little opaque medium passes through to the stomach. Johnstone and Woolen[14] have called attention to the lengthening of the beak followed by its obliteration on deep inspiration with subsequent expiration. They have shown that following retraction of the diaphragm a narrow stream of barium passes through the stenotic segment. Thus, respiratory activity may provide a sort of milking action. There is no bubble of gas in the fundus of the stomach. At the onset of this stage of cardiospasm, elongation of the esophagus may not be appreciable. Peristalsis is not demonstrable although on rare occasions multiple small segmental contractions may be seen which presumably represent the so-called tertiary contractions described by Templeton.[13]

Stage 4. Marked Enlargement (70 Cases): Advanced cardiospasm of long standing with marked dilatation, elongation and angulation of the esoph-

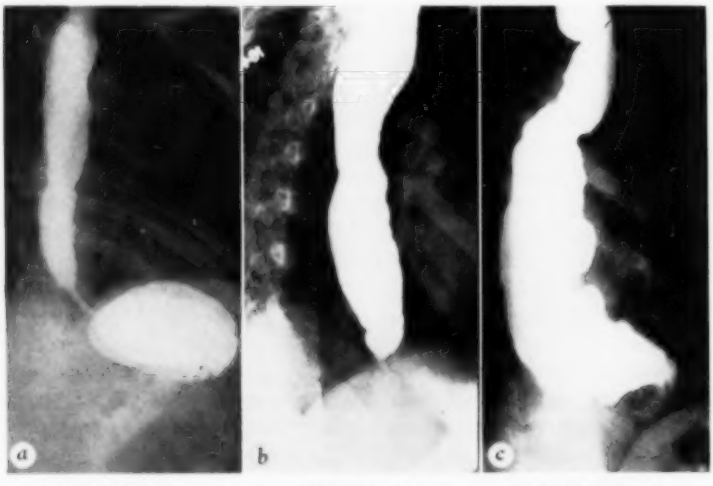

FIGURE 2a FIGURE 2b FIGURE 2c

Figure 2: Cardiospasm.—*2a:* Stage 2, moderate dilatation of esophagus.—*2b:* Stage 3, diffuse dilatation of esophagus.—*2c:* Stage 4, marked enlargement of esophagus with angulation. Complete obstruction at cardia in all except early stages during first roentgenoscopic examination. Several minutes later there is a moderate amount of barium in the stomach.

agus (Figure 2c) usually is recognized readily. In this decompensated form of cardiospasm the esophagus above the stenotic portion may be tremendously dilated. Occasionally it occupies almost the entire right half of the thorax. Usually the esophagus is a dilated and tortuous, patulous pouch filled with food and fluid. Frequently, its lower third assumes an S shape and this has been referred to as the "sigmoid esophagus" of cardiospasm. Frequently, too, the column of food and fluid when limited superiorly by its air-fluid level can be detected on roentgenoscopic examination before any barium is ingested (Figure 5). After ingestion the opaque fluid can be seen on roentgenoscopic examination to sink through the retained contents of the esophagus and outline the terminal portion of the organ. It is ordinarily possible to recognize the narrowed segment although commonly when no treatment has been given the opaque medium will not pass into the stomach. There is no evidence of muscular activity or peristalsis.

Esophagus After Treatment: Following adequate treatment by mechanical dilatation of the cardia, changes in the muscular activity of the esophagus are frequently demonstrable. The degree of motility depends on the magnitude of the changes produced in the esophagus by prolonged stasis. However, contractions are frequently evident after treatment of cardiospasm that was not too far advanced (that is, in stages 1, 2 and, in

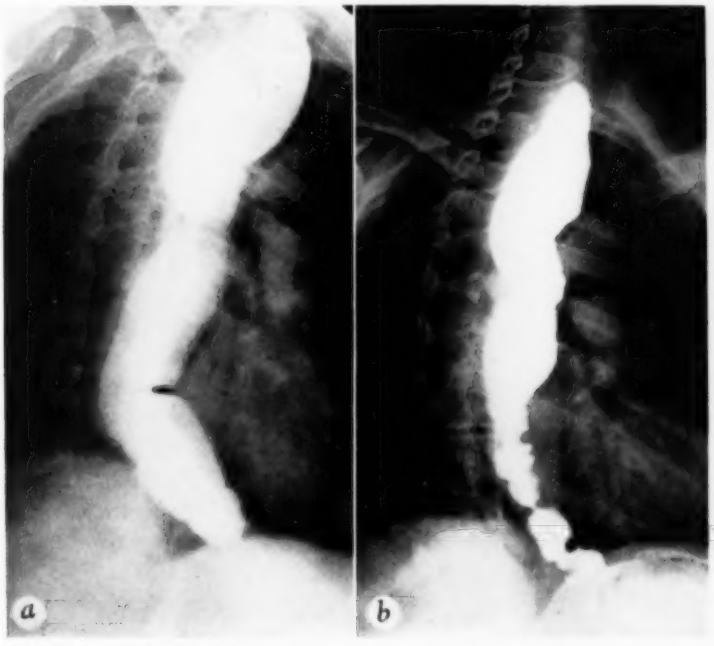

FIGURE 3a FIGURE 3b

Figure 3: Cardiospasm.—*3a:* Before treatment.—*3b:* Thirteen months after treatment: segmental appearance simulating irregular diffuse spasm may be noted.

some cases, in stage 3). There is also a striking change in the lower third to half of the esophagus; the appearance shortly after treatment resembles that of irregular diffuse spasm (Figure 3) and this may be maintained. Diffuse narrowing of the esophagus may be evident as compared with its appearance before treatment. More frequently the muscular activity of the lower segment resembles that of the so-called tertiary contractions of the esophagus.[13] There is ordinarily no retained food and fluid, and the mixture of barium and water enters the stomach through a narrowed cardiac orifice so that the stomach and duodenum may be examined. The appearance of the cardia usually resembles that seen in untreated cardiospasm but without knowledge of a previous dilatation an erroneous diagnosis of diffuse spasm, esophagitis, or some other lesion may be offered.

Further Considerations of Roentgenologic Diagnosis: Neoplastic stenosis of the cardia may simulate early cardiospasm roentgenologically. The presence of increased peristaltic activity is of no differential value because it is a manifestation of physiologic activity opposing the obstruction and is not peculiar to cardiospasm. Occasionally, a benign neoplasm located at or near the cardia may cause chronic obstruction of sufficient magnitude to result in prolonged stasis of food and fluid with secondary dilatation of the esophagus (Figure 4a). The dilatation may be marked and may resemble that of cardiospasm. At other times it may be impossible to dis-

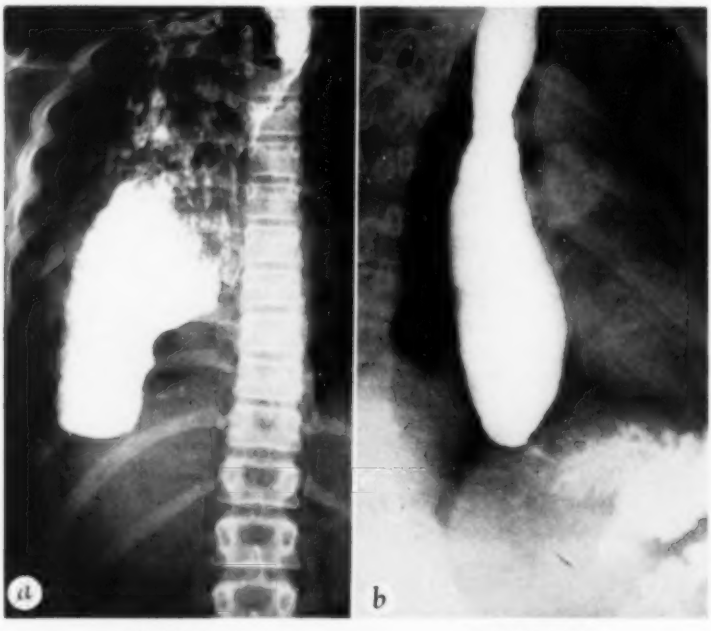

FIGURE 4a FIGURE 4b

Figure 4a: Dilatation of esophagus due to leiomyoma. Patient was a girl 14 years of age. The dilatation resembles that of cardiospasm.—*4b:* Carcinoma at the cardia simulating cardiospasm.

tinguish an intraluminal benign tumor from accumulations of food due to cardiospasm.

The most important differentiation to be made is that between obstruction due to cardiospasm and that due to carcinoma of the cardia and lower part of the esophagus (Figure 4b). This may be difficult or impossible roentgenologically in the early stages. As cardiospasm becomes more chronic, its roentgenologic aspects are less likely to be confused with those of neoplasm. Obstruction, due to carcinoma may be partially intermittent because it may be temporarily relieved by slough of tissue. It is unusual for a patient with an obstructing carcinoma of the cardia to survive long enough to permit the development of marked dilatation of the esophagus. Stenosis of the cardiac orifice from other causes, such as ulceration or stricture, likewise may simulate cardiospasm roentgenographically. Dilatation resulting from stricture or foreign body is usually not marked and the constricted segment is ordinarily longer and at a higher level than it is in cardiospasm.

Early cardiospasm may be confused roentgenologically with diffuse spasm, and the differentiation is most important. Occasionally, tertiary esophageal contractions accompanying early untreated cardiospasm may be recognized on roentgenoscopic examination. These small, segmental, ineffectual contractions simulate an irregular diffuse spasm. In the latter condition, however, there is no prolonged or unrelieved stenosis at the cardia and no evidence of passive dilatation above the constricted segment. If the mechanical dilatation of cardiospasm has taken place this should appear in the lower half of the esophagus. Further consideration will be given to this condition in the differential diagnosis.

In cases of scleroderma, changes in the outline of the barium-filled esophagus may resemble those of cardiospasm. This is probably infrequent because, although motility of the esophagus is decreased in scleroderma, the wall is usually stiffened so that stasis of ingested material, if it occurs, is less likely to cause much passive dilatation of the organ. When lesions which may decrease the motility of the esophagus, such as scleroderma, tabes or myasthenia gravis, are present, the esophagus usually empties readily when the patient is upright. Associated conditions will be considered later.

The administration of amyl or octyl nitrite and recently of procaine hydrochloride has been advocated to relax the functional cardiac sphincter during examination and thereby to prove the absence of an organic obstruction. Opinion varies as to the value of this technic because it does not relieve all obstructions due to cardiospasm. We have not used this method but prefer to employ the passage of sounds, esophagoscopy and biopsy when the diagnosis is uncertain.

Cardiospasm when accompanied by sufficient dilatation or by dilatation and elongation of the esophagus may be suspected by examination of the ordinary roentgenogram of the thorax made with the patient in the upright position. The shadow of the dilated, fluid-filled organ may be observed extending into the right hemithorax from the mediastinum (Fig-

ure 5a). The dilatation is usually more evident in its lower half but this is not invariably true, and it is possible to have the most obvious dilatation in the middle third or upper half of the esophagus (Figure 5b). In the sigmoid-shaped esophagus the organ extends more to the right in its lower portion. Frequently, a fluid level can be recognized somewhere below the level of the cricopharyngous muscle. Particles of food dispersed in the retained fluid may impart a mottled appearance to the widened mediastinum. The right border of the esophageal shadow frequently can be followed superiorly to a level above the thoracic inlet. There is no air bubble in the stomach because swallowed air cannot pass through the column of fluid.

Endoscopic Considerations

Esophagoscopy plays a rather limited role in the diagnosis of cardiospasm. An accurate diagnosis can usually be made by correlating the history with the roentgenoscopic findings. As a rule, little will be gained by passing an esophagoscope into an organ filled with food and debris. If diagnostic esophagoscopy is indicated, the examination will be more satisfactory after the obstruction at the cardia is relieved. Such relief is best obtained by passing olive-tipped bougies and sounds through the cardia over a previously swallowed thread. The sensation experienced by the endoscopist as the bougie overcomes the resistance at the cardia is characteristic when cardiospasm is present. The passage of a bougie is a valuable method of distinguishing cardiospasm from nonsphincteric or diffuse spasm of the esophagus as well as from organic lesions. The roentgenologist usually has little difficulty in ascertaining the nature of organic obstructions of the lower part of the esophagus, but if he does, esopha-

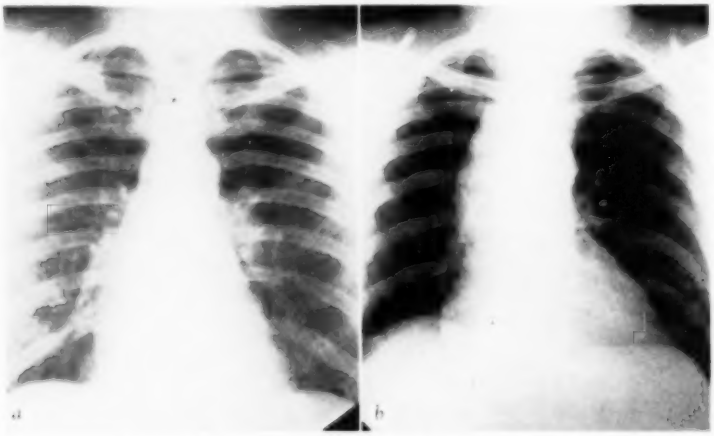

FIGURE 5a FIGURE 5b

Figure 5: Fluid filled esophagus in plain roentgenograms of the thorax.—*5a:* Fluid filled esophagus may be noted along the right border of the heart.—*5b:* Upper half of esophagus dilated.

goscopy may be very helpful. More often cardiospasm must be differentiated from carcinoma of the cardia or cardiac end of the stomach, and such lesions may be difficult to reach with the esophagoscope. Thus, esophagoscopic examinations may fail in those cases in which the roentgenologist is in greatest need of help.

Esophagoscopy was performed in 110 of our 601 cases. In 72 cases the esophagoscopic examination was done because of some doubt as to the diagnosis. In the remaining 38 cases, esophagoscopy was required to effect dilatation because obstruction was so severe that a swallowed thread could not be passed into the stomach. When esophagoscopy is necessary to open the cardia, the procedure is difficult and somewhat hazardous. Perforation may occur and there is always the possibility of pneumonitis from aspirated esophageal contents.

Associated Conditions

An effort has been made to correlate the incidence of associated diseases with cardiospasm. Of our 601 patients, 25 had duodenal ulcer, 23 had gallbladder disease and 10 had diaphragmatic hernias. Two had gastric carcinomas and one a gastric ulcer. Carcinoma of the colon was found twice. Ten patients had heart disease, five had goiters, three had stones in the urinary tract and one had calcinosis. As far as the afore-mentioned conditions are concerned, the incidence of these conditions is not greater than may be expected among approximately 600 persons of assorted ages.

Other conditions were noted, however, which have special interest. The simultaneous occurrence of diffuse spasm and cardiospasm occurred 40 times in our 601 cases. Although the usual problem is the differentiation of these conditions, they can occur together in the same patient or these conditions may occur at different times in the same person.

Much has been written, especially by Brazilian authorities,[7] concerning the coexistence of cardiospasm and megacolon. Alvarez[22] has pointed out the similarities between these conditions, especially with respect to the defect in the myenteric plexus. Megacolon occurred once in this series of 601 cases. The patient was a boy, six years of age.

Esophageal diverticula were noted in seven cases in this series. Three of these diverticula were traction diverticula of the midesophagus, while four were pulsion diverticula (epiphrenic) of the lower part of the esophagus. Dysphagia without esophagectasis is a rather common accompaniment of many esophageal diverticula, especially those of the pulsion variety, but in the seven cases in our series, cardiospasm was well developed. It is conceivable that these diverticula interfere with the orderly propagation of the peristaltic waves. Hence, achalasia (or failure of the cardia to open) may be the result of mechanical interference with the normal mechanism of deglutition.

The association of cardiospasm with bulbar palsy in two cases is likewise of interest. The primary peristaltic waves of the esophagus have their origin in the striated muscle of the upper part of the esophagus and are initiated as a result of the projectile activity of the hypopharynx.[12,13] As

Womack and his associates[12] have pointed out, the defect in some patients with cardiospasm may be in the primary waves instead of the secondary waves of the smooth muscle portion.

There are numerous references in the literature to the development of carcinoma of the esophagus in patients with cardiospasm.[23] In our series this occurred only once, although carcinoma associated with cardiospasm was noted in two or three patients first seen prior to 1935.[24] It is our impression that there is no predilection for the development of carcinoma in these patients.

The occurrence of cardiospasm in patients with diaphragmatic hernias is interesting (Figure 6a). It certainly tends to discredit the theory that a tight or spastic diaphragmatic pinchcock is the cause of cardiospasm. There is ample evidence to indicate that this pinchcock plays an important part in maintaining the integrity of the sphincter at the cardia and preventing regurgitation of gastric chyme.[25] However, as far as the pathogenesis of cardiospasm is concerned the evidence strongly favors a disturbance of esophageal motility rather than a defect of the hiatus of the diaphragm. One patient of particular interest had had an esophagogastric junction well below the hiatus (Figure 6b).

Cardiospasm in Children

Among the 601 patients were 17 children of 15 years of age or less; eight of these 17 were less than 10 years of age. Symptoms of 24 of the 601 patients developed in the first 10 years of life. All 24 patients had the classical symptoms and roentgenologic findings of cardiospasm. As Moersch[26] pointed out in 1929, cardiospasm often goes unrecognized in infants and children.

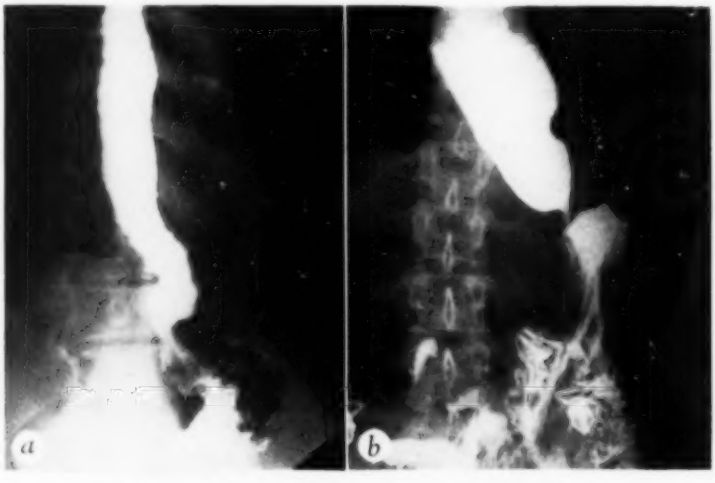

FIGURE 6a FIGURE 6b

Figure 6a: Esophageal hiatus hernia with cardiospasm.—*6b:* Patient with cardiospasm with esophageal hiatus well below diaphragm.

The condition may be mistaken for croup or chronic respiratory disease, or the child may be considered to have a feeding problem. Early diagnosis is most important so that treatment may be instituted before the disease becomes far advanced or serious suppurative disease of the lungs occurs.

Differential Diagnosis

The diagnosis of well-established cardiospasm is rarely difficult. The history and the roentgenologic findings are usually sufficient and the findings when a bougie is passed over a thread into the stomach are so characteristic that mistakes in diagnosis should be uncommon. It is usually difficult or impossible to pass a No. 41 F. olive-tipped bougie through a cicatricial stricture or neoplastic lesion, and such obstructions are usually firm. In cases of diffuse spasm, spastic resistance is offered to passage of a bougie in the midesophagus and this resistance continues all the way to the stomach.

As said previously, carcinoma of the cardiac end of the stomach and cardiospasm may resemble each other closely, especially during early stages. A reflex spasm may occur at the cardia in patients with carcinomas of the upper part of the stomach or even with peptic ulcers of the stomach or duodenum, gallbladder disease or pancreatitis. Carcinomas of the cardia should be suspected whenever undue resistance is offered to the passage of sounds. It is often desirable to re-examine the stomach roentgenoscopically after the cardia has been dilated. Esophagoscopy should be done, but if biopsy of tissue removed through the esophagoscope from the cardia fails to reveal carcinoma, this does not exclude malignant disease. When doubt exists, smears should be made[27] and secretions aspirated from the cardia for cytologic study. Patients for whom the diagnosis is questionable should

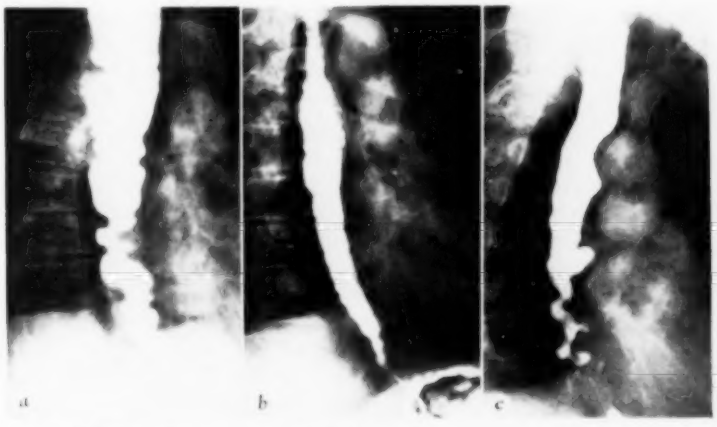

FIGURE 7a FIGURE 7b FIGURE 7c

Figure 7: Diffuse spasm of esophagus.—*7a:* Diffuse irregular spasm.—*7b:* Diffuse constant narrowing.—*7c:* Pseudo-diverticulosis. From Olsen, A. M., Harrington, S. W., Moersch, H. J. and Anderson, H. A.: "The Treatment of Cardiospasm. Analysis of a Twelve-Year Experience," *J. Thoracic Surg.*, 22:164-187 (Aug.) 1951.

be studied carefully, and if there is reasonable doubt as to the nature of the condition, transthoracic exploration is justified.

Cicatricial changes at the cardia are sometimes noted in patients with advanced cardiospasm and especially in those who have had a split esophagus or a severe reaction following dilatation with the hydrostatic bag. Overdistention of the cardiac sphincter may permit regurgitation of acid gastric chyme, thus producing peptic esophagitis and subsequent cicatricial changes. Actual shortening of the esophagus may result. However, in contrast to the findings of some other observers, the development of fibrosis at the cardia has been the exception rather than the rule in our patients.

In the literature a clear-cut distinction has not always been made between cardiospasm and diffuse spasm of the esophagus. Diffuse spasm of the esophagus was described by Moersch and Camp[28] and further studied by Schmidt.[29] It is a spasm of the smooth muscle portion of the esophagus and extends from the upper or midesophagus to the cardia. Diffuse spasm may appear roentgenographically as in Figure 7.

The esophageal contractions of diffuse spasm apparently give rise to pain or obstruction or both. Pain is a rather constant feature of diffuse spasm and is usually severe. The pain is substernal and is referred to the thoracic portion of the back or to the mouth, throat, ears, shoulders or arms. It may or may not be associated with obstruction. The obstruction begins in the midportion of the esophagus and its site is most clearly evidenced when bougies are passed. Obstruction may be partial or complete. As a rule, the symptoms of diffuse spasm are intermittent and vary greatly in intensity. This syndrome tends to occur in highly nervous individuals. However, it is also seen in conjunction with a variety of other digestive disorders, including disease of the gallbladder, peptic ulcer of the stomach or duodenum, esophageal hiatal hernia and esophagitis. Esophagitis per se may produce symptoms similar to those of diffuse spasm. However, esophagoscopic examination of patients with diffuse spasm will reveal a normal mucosa more often than not. Of particular importance is the fact that the treatment of diffuse spasm, unlike that of cardiospasm, is most unsatisfactory. Hence, it is important to differentiate diffuse spasm from achalasia or cardiospasm.

Diffuse spasm and cardiospasm may occur in the same patient. The combination of these conditions may seem confusing and some elucidation is necessary. The principal and constant obstruction in these cases, as demonstrated roentgenographically and by passage of bougies, is at the cardia. The roentgenologist recognizes the characteristic patterns of diffuse spasm as the barium passes. Clinically the diffuse spasm is usually manifested by frequent attacks of pain. After treatment with the hydrostatic dilator the obstruction is usually relieved but episodes of esophageal pain are likely to persist. Sometimes these patients require considerable observation before a decision can be made as to whether they have cardiospasm, diffuse spasm or both.

Scleroderma: The esophageal lesions of scleroderma are most interesting. A series of 18 cases was reported by Olsen, O'Leary and Kirklin[30] in 1945.

Seven of these patients had roentgenologic and endoscopic evidence of cardiospasm. In most instances the degree of dilatation was slight or moderate. These patients are not included in the present series because the primary disease process was acrosclerosis. Sclerodermatous changes in the walls of the esophagus are responsible for the development of a clinical picture closely simulating cardiospasm. These considerations would certainly lend support to the concept that the neuromuscular apparatus of the esophagus is at fault in achalasia.

Comment

The exact etiology of cardiospasm is not known. At present we cannot assess possible causes of cardiospasm, such as psychic trauma, vitamin B deficiency and primary degeneration of Auerbach's plexus. When we reviewed the records of our 601 cases, we made an attempt to evaluate the nervous and emotional factors. At least two thirds of our patients appeared superficially to be stable individuals. At times these individuals seemed to relate the onset of their dysphagia to psychic shock or emotional conflicts. When a serious effort was made to probe for a possible psychosomatic origin for cardiospasm, as was done by McMahon, Braceland and Moersch,[31] anxiety neuroses or emotional conflicts could almost always be elicited. Regardless of the role of psychiatric disturbances, it is our impression that cardiospasm has an organic basis. Once the disease is established we question that much will be accomplished by psychotherapy.

Studies of the physiology of the esophagus and cardia are in progress in our laboratories[20] and elsewhere.[9,11] Most of the evidence accumulated thus far suggests that the principal defect is in the esophageal musculature and its propulsive mechanism. Apparently, the cardia, like other sphincters, opens in response to a peristaltic wave. Regardless of whether the cardia is hypertonic or the neuromuscular mechanism of the esophagus is inadequate, the principal methods of treatment in favor today are directed toward weakening the resistance of the cardia. That the closure mechanism at the cardia should not be destroyed is attested by many observations. It has been shown that surgical procedures which eliminate the sphincter property of the cardia are undesirable.

In the early stages of cardiospasm the motor mechanism of the esophagus may be impaired, but apparently it is still helpful in propelling food into the stomach. Furthermore, in this the "compensated" stage,[8] the muscular walls and especially the circular layer of the esophagus are capable of hypertrophy. Stretching of the sphincter or cardiomyotomy are most efficacious in these early cases. In more advanced cardiospasm, esophageal activity ceases and the swallowing mechanism must depend on gravity and changes in intrathoracic pressure. In the hugely dilated and tortuous esophagus with rigid walls, the mechanical problems of alimentation become extreme. Obviously, cardiospasm is most responsive to treatment in the early stages.

The diagnosis of cardiospasm is not difficult even in the early stages. If the physician pays proper attention to the patient's symptoms and if

an adequate roentgenologic examination of the esophagus is made, the diagnosis should be detected in every case before the "decompensated phase" develops. Yet, too often patients are seen with advanced megaesophagus who have never even had a previous esophagram. These patients may have had cardiospasm for years and no effort has been made to dilate the cardia. All too often the patient's dysphagia has been regarded casually and considered to be a purely functional symptom. Cardiospasm is a pathologic entity and should not be treated lightly or not at all. Satisfactory methods of treatment are available, especially in its earlier stages and physicians should recognize the disease early and see that it is treated promptly.

SUMMARY

Cardiospasm, or achalasia, is a nonorganic stenosis of the lower end of the esophagus. This condition must be distinguished from esophageal spasm (diffuse spasm) and reflex spasm at the cardia. During a twelve-year period, 601 patients with cardiospasm were seen and treated at the Mayo Clinic. There were 327 males and 274 females. The ages of these patients at the time of the onset of their symptoms and at the time of consultation is depicted in Figure 1. The patients varied in age from two to 88 years. There were 17 children included in the group who were less than 15 years of age. Data concerning the duration of symptoms are included in Table I.

The symptoms of cardiospasm are obstruction to swallowing, regurgitation and pain. Although obstruction and regurgitation are common symptoms, pain occurred in only 29 per cent of the cases. Hemorrhage from the esophagus occurred in but 2.5 per cent. Pulmonary complications of cardiospasm were recognized in 10 per cent of the entire group and are reported elsewhere.

The most important diagnostic procedure in these cases is the roentgenologic examination. The roentgenoscopic diagnosis is based on observation of a barium-filled esophagus. A number of roentgenologic observations are necessary for the diagnosis of cardiospasm. These are as follows: (1) the outline of the constricted segment at the cardia; (2) the degree of obstruction at the cardia; (3) the extent of the enlargement or dilatation of the esophagus above the constricted segment; (4) the length and course of the esophagus; (5) evidence of retained food and fluid within the esophagus, and (6) alterations in the muscular activity of the esophagus.

From a roentgenologic point of view, cardiospasm may be divided into four stages based on the degree of dilatation of the esophagus. Stage 1 is essentially a normal appearing esophagus but with evidence of obstruction at the cardia. Diagnosis is often difficult at this stage. Stages 2, 3 and 4 represent advancing degrees of dilatation. The incidence of these stages in our series can be ascertained from Table I. In general, it may be stated that the motility of the esophagus is increased during stages 1 and 2 and either reduced or absent in stages 3 and 4. Stages 2, 3 and 4 are illustrated in Figure 2. The roentgenographic appearance of the esophagus after

mechanical dilatations of the cardia deserves special comment. Some degree of motility is recovered by the esophagus and the appearance is similar to that noted in diffuse spasm.

In the differential diagnosis of cardiospasm, carcinoma of the cardiac end of the stomach is the most important condition to be considered. At times carcinoma of the cardia may closely simulate cardiospasm, as illustrated in Figure 4b. Esophagoscopy is usually unnecessary in making the diagnosis of cardiospasm but is sometimes desirable in the effort to exclude carcinoma. Esophagoscopy was performed 110 times in our 601 cases. Seventy-two esophagoscopic examinations were done for diagnostic purposes and the rest were done to assist in the treatment. In our experience, the passage of sounds often has more diagnostic value than esophagoscopy. Diffuse spasm of the esophagus must likewise be differentiated from cardiospasm. It should be pointed out that cardiospasm and diffuse spasm may occur in the same patient. Although the coexistence of cardiospasm and megacolon has been reported commonly in South America, these diseases occurred together only once in our series. In this instance a boy, six years old, had both cardiospasm and megacolon. The associated occurrence of esophageal diverticula, diaphragmatic hernias and bulbar palsy in patients with cardiospasm introduced interesting speculations as to the etiology of this condition.

Degenerative changes in Auerbach's plexus are commonly demonstrated in patients who have had cardiospasm. The reason for these changes is not clear and the etiology of cardiospasm remains obscure. In our opinion, it is probably not primarily a psychosomatic disease. It is important that the diagnosis of cardiospasm be made early, before the decompensated stages have set in.

RESUMEN

El cardiespasmo o acalasia es una estenosis no orgánica del segmento inferior del esófago. Esta condición se debe distinguir del espasmo del esófago (espasmo difuso) y del espasmo reflejo del cardias. Durante un periodo de 12 años, 601 pacientes con cardiespasmo fueron vistos y tratados en la clinica Mayo. Tresientos veinte siete eran hombres y 274 mujeres. Está incluida en la figura 1 las edades de estos pacientes cuando empezaron los sintomas y cuando consultaron. Los pacientes variaban en edad de 2 a 88 años. Habian 17 niños menores de 15 años. Los datos concernientes a la duración de los sintomas estan incluidos en el cuadro I.

Los sintomas del cardiespasmo son: obstrucción al deglutir, regurgitación y dolor. Aunque la obstrucción y la regurgitación son síntomas comunes, el dolor apareció solo en un 29 por ciento de los casos. Hemorragia del esófago en un 2.5 por ciento. Complicaciones pulmonares del cardiespasmo fueron reconocidas en un 10 por ciento y están referidas en otra parte.

El recurso mas importante para el diagnóstico es en estos casos el examen roentgenológico. El diagnóstico roentgenoscópico está basado en el examen de el esófago lleno de bario. Ciertas observaciones roentgenológicas son necesarias para el diagnóstico del cardioespasmo. Estas son: (1) el delinea-

miento del segmento en constricción en el cardias; (2) el grado de obstrucción del cardias; (3) la extensión del alargamiento o dilatación del esófago por encima del segmento en constricción; (4) la longitud y curso del esófago; (5) evidencia de comida y líquido detenida en el esófago; (6) alteraciones en la actividad muscular del esófago.

Desde el punto de vista roentgenológico el cardiespasmo puede ser dividido en cuatro etapas basadas en el grado de dilatación del esófago. La 1a etapa presenta un esófago de apariencia normal pero con evidencias de obstrucción en el cardias. El diagnóstico en este periodo es a menudo difícil. Las etapas 2, 3 y 4 representan grados avanzados de dilatación. La incidencia de estos periodos en nuestras series pueden ser confirmada en el cuadro I. En general se puede establecer que la motilidad del esófago esta aumentada durante las etapas 1 y 2 y reducida o ausente en la 3 y 4. Los periodos 2, 3 y 4 están ilustrados en la figura 2. La apariencia roentgenográfica del esófago después de las dilataciones mecánicas del cardias merece un comentario especial. Cierto grado de motilidad es recobrado por el esófago y la apariencia es similar a la que se nota en el espasmo difuso.

En el diagnostico diferencial del cardioespasmo, es importante considerar el carcinoma de la porción cardiaca del estómago. Algunas veces el carcinoma del cardias puede parecer cardioespasmo, tal como muestra la figura 4b. La esofagoscopia es a menudo innecesaria para hacer el diagnóstico del cardioespasmo pero a veces es deseable en un para excluir el carcinoma. La esfagoscopia fué llevada a cabo en 110 de nuestros 601 casos. Setenta y dos de ellas fueron llevadas a cabo para realizadas con fin diagnóstico y el resto fueron hechas para ayudar en el tratamiento. En nuestra experiencia el paso de sondas a menudo tiene mas valor que la esofagoscopia. El espasmo difuso del esófago debe ser también diferenciado del cardioespasmo. Debe hacerse notar que el cardioespasmo y el espasmo difuso pueden coexistir en el mismo paciente. A pesar de que se ha referido comúnmente la coexistencia del cardioespasmo y el megacolon en Sud America, estas enfermedades solo aparecieron juntas una vez en nuestras series. En esa ocasión un niño de 6 años tenía ambos: cardiespasmo y megacolon. La asociación de los divertículos del esófago, hernias diafragmáticas y de parálisis bulbar en pacientes con cardioespasmo son motivo de interesantes especulaciones acerca de la etiología de esta afección.

Cambios degenerativos en el plexo de Auerbach son comúnmente demostrados en pacientes con cardioespasmo. La razón de estos cambios no está clara y la etiología del cardioespasmo permanece obscura. En nuestra opinión no es primariamente una enfermedad psicosomática. Es importante que el diagnóstico del cardioespasmo sea hecho precozmente antes que las etapas descompensadas se hayan establecido.

RESUME

Le cardiospasme est une sténose anorganique de l'extrémité inférieure de l'oesophage. Il faut le distinguer du spasme oesophagien (spasme diffus) et du spasme réflexe du cardia. Au cours de douze années, on a vu et traité à la Clinique Mayo 601 malades atteints de cardiospasme: 327 hommes et

274 femmes. L'âge des malades au moment de l'apparition de leurs symptômes et au moment de l'examen a été développé sur la figure 1. L'âge des malades variait de 2 à 88 ans. Parmi eux, il y avait 17 enfants âgés de moins de 15 ans. Le temps pendant lequel s'est étendue la symptomatologie se trouve consigné sur le Tableau I.

Les symptômes du cardiospasme sont la difficulté de la déglutition, les régurgitations et la douleur. Alors que la déglutition difficile et les régurgitations sont des symptômes habituels, ce n'est que dans 29% des cas qu'on a noté de la douleur. Seuls 2.5% des malades présentèrent une hémorragie d'origine oesophagienne. On a mis en évidence des complications pulmonaires du cardiospasme chez 10% de l'ensemble du groupe. Elles sont rapportées ailleurs.

La phase diagnostique la plus importante dans ces cas est l'examen radiologique. Le diagnostic radioscopique se base sur l'observation de l'oesophage empli de baryte. Pour faire le diagnostic de cardiospasme, il faut un certain nombre d'observations radioscopiques. Les manifestations sont les suivantes: (1) la délimitation de la zone sténosée du cardia; (2) l'importance de l'obstruction du cardia; (3) l'étendue de l'élargissement ou de la dilatation oesophagienne, en amont de la zone sténosée; (4) la longueur de l'oesophage; (5) la mise en évidence de rétention d'aliments ou de liquide à l'intérieur de l'oesophage; (6) les altérations de l'activité musculaire de ce viscère.

Au point de vue radioscopique, on peut diviser le cardiospasme en quatre étapes, basées sur le degré de dilatation de l'oesophage. La première étape est essentiellement un oesophage d'aspect normal mais avec lequel existe une obstruction du cardia. Le diagnostic est souvent difficile à ce moment. Les deuxième et quatrième étapes appartiennent à la dilatation progressive de l'oesophage. Le tableau I montre l'incidence des différentes étapes chez les malades examinés. En géneral on peut établir que la mobilité de l'oesophage s'accroit durant les première et deuxième étapes et ou bien se réduit, ou bien est totalement absente dans les étapes trois et quatre. La figure 2 illustre les caractéristiques des étapes deux, trois et quatre. L'aspect radioscopique de l'oesophage après dilatation mécanique du cardia demande un commentaire particulier. On note la réapparition d'une certaine motilité de l'oesophage et l'aspect ressemble à celui qui a été observé dans le spasme diffus. Le diagnostic différentiel du cardiospasme qui est le plus important à considérer est celui de cancer du cardia. Dans certains cas, le cancer du cardia simule très exactement un cardiospasme, comme on peut le voir sur la figure 4b. En général l'oesophagoscopie est inutile pour faire le diagnostic de cardiospasme, mais elle peut être souhaitable pour éliminer le cancer. Dans les 601 cas présentés par les auteurs, l'oesophagoscopie fut faite 110 fois. 72 oesophagoscopies furent pratiquées dans un but diagnostic et les autres comme complément du traitement.

Les auteurs dans leur pratique, ont l'impression que le passage de la sonde à souvent plus de valeur au point de vue diagnostic que l'oesophagoscopie. Il faut également différencier du cardiospasme le spasme diffus de l'oesophage. Les auteurs insistent sur le fait que le cardiospasme et le spasme

diffus peuvent survenir chez le même malade. Bien que la coexistence de cardiospasme et de mégacolon à été rapportée de façon commune en Amérique du Sud, les auteurs n'ont constaté qu'une seule fois la coexistence des deux affections dans la série des malades qu'ils ont observée. Il s'agissait alors d'un jeune garçon de six ans, atteint de ces deux affections. L'association de diverticules oesophagiens, de hernies diaphragmatiques, et de paralysies bulbaires chez les malades atteints de cardiospasme permet d'envisager d'une façon intéressante le problème étiologique.

On à découvert de façon courante l'existence d'altérations dégénératives du plexus nerveux d'Auerbach chez des malades atteints de cardiospasme. L'origine de ces altérations n'est pas claire, et l'étiologie du cardiospasme reste obscure. Les auteurs estiment qu'il ne s'agit probablement pas d'une affection primitivement psycho-somatique. Il est important de faire précocement le diagnostic du cardiospasme avant l'apparition de la période de décompensation.

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Discussion

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Before direct discussion of Dr. Olsen's excellent paper, it seems timely to note that diseases of the esophagus constitute an added subject on these programs. Originally papers were limited almost entirely to the subject of tuberculosis; soon other bronchopulmonary diseases were added, then the heart and its newer surgery, and now the esophagus as an intrathoracic organ is receiving increasing attention at these meetings.

It is difficult to do more than praise this excellent presentation, one which is based on a vast clinical experience and arrives at conclusions from a careful analysis of statistics. The subject of cardiospasm is an important one in diseases of the chest because of the frequent association of cough as one of its prominent symptoms. Our records suggest that pulmonary symptoms are much more frequently observed, sometimes as the primary symptom, than Dr. Olsen's stated 10 per cent. Bronchopulmonary complications such as bronchiectasis, lung abscess, and suppurative bronchitis often constitute a group of severe pulmonary conditions due to cardiospasm. The cough, so often complained of by patients when lying down at night, due to an overflow of secretions and retained food from the esophagus into the pharynx and larynx, is one of the common symptoms of cardiospasm.

On one point I should definitely disagree with Dr. Olsen. Diagnostic esophagoscopy was performed in only about 10 to 15 per cent of his cases, and he stated that this procedure was rarely necessary unless the diagnosis was in doubt. We feel that diagnostic esophagoscopy is imperative. First, it permits visual confirmation of the tentative roentgen diagnosis. Second,

it permits an accurate differential diagnosis between cardiospasm and a possible slowly growing benign or malignant tumor, and cardiospasm—an important feature since some slowly growing carcinomas may permit surprisingly marked esophageal dilatation to take place. And third, esophagoscopy permits an evaluation of the region of the cardia associated with the primary condition so that a more accurate therapeutic program may be carried out.

The diagnosis of cardiospasm in infants is another subject of great interest I had hoped Dr. Olsen would discuss more thoroughly. That such a condition exists even in the newborn raises further questions regarding the etiology of cardiospasm. Possibly Dr. Olsen could elaborate on this subject in his closing remarks since he and Dr. Moersch have had an interesting series of such patients.

The Physiologic Evaluation of Patients Before and After Mitral Commissurotomy*

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Cardiac catheterization is a technique which readily lends itself to the analysis of hemodynamic alterations in the cardio-pulmonary circuit caused by mitral stenosis. The purpose of this report is the evaluation of 50 patients with mitral stenosis by means of this technique, attempting thereby to determine optimal indications for mitral commissurotomy. Of the 50 patients studied, 27 subsequently were subjected to commissurotomy. The 50 patients were carefully selected in an effort to exclude all except those with "pure" mitral stenosis. However, two had a significant degree of mitral insufficiency. Seven had minimal aortic insufficiency without signs of peripheral aortic regurgitation such as a collapsing pulse. All had predominantly right ventricular hypertrophy as evaluated by the electrocardiogram or x-ray film. The usual catheterization techniques of Cournand[1] were employed and the derived calculations have in general conformed to the methods of Dexter[2-5] and Bing.[6]

The patients were divided into three groups on the basis of resting pressure levels in the pulmonary artery and right ventricle. The first group consisted of those whose pulmonary artery systolic pressure was less than 50 mm./Hg. The second group consisted of patients whose pulmonary artery systolic pressure was greater than 50 mm./Hg, and the third group were in failure, i.e., those with elevated right ventricular diastolic pressure. In all but one in the third group the pulmonary artery systolic pressure was greater than 50 mm./Hg. Thus, in the third group, right ventricular diastolic pressure elevation was an important factor in the high mean pulmonary artery pressure.

Table I shows the resting mean pulmonary artery pressure, cardiac output, and pulmonary resistance in the three groups. First, the cardiac output in patients in mitral stenosis without failure is within the normal range. Second, the mean cardiac outputs in Group I and Group II patients are identical. When the right ventricle fails (Group III), there is a further increase in pulmonary artery pressure coincident with a decrease in cardiac output. The differences between the three groups are best brought out by consideration of the ratio of pressure to flow, i.e., resistance. It can be seen to rise markedly from group to group. Between Groups I and II, the increase in resistance is due entirely to the increase in mean pulmonary

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artery pressure, whereas between Groups II and III, the increment is a reflection of both the pressure rise, and the fall in cardiac output.

In addition, Table I shows the mean oxygen consumption, A-V oxygen difference and work of the right ventricle in each of the three groups. Oxygen consumption is slightly reduced in the patients with right heart failure. The drop in cardiac output in those with failure is primarily due, however, to increased arteriovenous oxygen difference (a rise of 21 per cent), rather than to changes in oxygen consumption (fall of 5.7 per cent). Levels of right ventricular work, like resistance, vary in the three groups. The right ventricular work of the patients in Group I is at the upper limit of normal (upper limit of normal for right ventricular work 1 KgM/min/sqM body surface[2]). Patients in Group II, because of the markedly elevated pulmonary artery pressures show a great increase in right ventricular work over the normal. Patients in Group III show a slight decrease in the work load from those in Group II. This decrease represents an inability of the heart to maintain a normal cardiac output in the face of increasing pulmonary artery pressure.

The effect of exercise on pressure, flow, resistance, etc., was next considered in a group of 20 of the 50 patients (Table II). These were classified into the same previous subgroups, depending on the same pressure levels. All except one showed an increase of mean pulmonary artery pressure on exercise. The mean increase in pressure was small (27 per cent), in Group I, but twice as great (57 per cent) in Group II. In Group III (the patients in failure), a smaller pressure rise was noted. In all except one the cardiac output rose on exercise. Flow increases were moderate in Groups I and II (about 40 per cent) but much less in Group III (18 per cent). These increases in cardiac output were far below the normal doubling of cardiac output on exercise.[7] The entire dynamic relationships are again better reflected by consideration of the changes of resistance, rather than of the changes in pressure and flow alone. In the patients with a low initial pulmonary artery pressure, a decrease in pulmonary vascular resistance occurred with exercise, since flow increased more than pressure. In those with higher initial pressure levels (Group II), resistance increased on exercise since pressure increments were greater than flow increments. In the patients with failure, no real change occurred, since pressure and flow both increased slightly. In analyzing oxygen consumptions, and A-V differences, the same general features are noted as before. Oxygen consumption varied little from group to group, and the increments of oxygen consumption on exercise varied little. A greater change was present in the A-V oxygen differences which were increased in Group III and rose most during exercise in this group. Oxygen saturation of arterial blood remained essentially the same in all groups following exercise. Increments in the work of the right ventricle were greatest in Group II because of the greater increase in pulmonary artery pressure on exercise.

It may be stated, then, our groups followed the known features of the dyskinetic syndrome of Harrison.[8] As mitral stenosis develops, the pulmonary artery pressure rises. The group in failure have a higher mean

pulmonary artery pressure than those not in failure. In mitral stenosis the cardiac output at rest falls only when heart failure is present and not measurably until that time. Thus, pressure levels become more important than flow levels in the evaluation of the patient. But resistance and work are still more sensitive criteria of the state of the right ventricle.

Pulmonary capillary pressures were measured in 24 patients (Table I). As expected the level of the capillary pressure was about twice as high in Group II patients as in Group I patients, and highest in those in Group III. The gradient between mean pulmonary artery and pulmonary capillary pressure and the pulmonary arteriolar resistance also increased with decreased cardiac function. These findings agree in general with those of Gorlin.[3,4] It was found, along with Lucas and Dotter[9] that pulmonary artery pressures varied widely at any given level of pulmonary capillary pressure; this unexplained variability of pulmonary arteriolar resistance warrants further study.

Three patients in the total series had borderline mean pulmonary artery pressures. This was an unexpected finding in all three, and their subsequent clinical course deserves special mention. Of the three cases, two

TABLE I

PHYSIOLOGIC MEASUREMENTS OF FIFTY PATIENTS WITH MITRAL STENOSIS AT REST

	Normal Values*	Group I	Group II	Group III
Number of Patients		18	15	17
Mean Pulmonary Artery Pressure, mm Hg.	10-20	*28	45	65
Mean Pulmonary "Capillary" Pressure, mm Hg.	6-12	15	25	38
Pulmonary Artery-Pulmonary "Capillary" mean Pressure Gradient, mm Hg.	4-10	12	20	33
Mean Right Auricular Pressure, mm Hg.	0-6	4.3	5.6	12.5
Cardiac Output Litres Per Minute	4.5-8.0	4.57	4.87	3.60
Cardiac Index, Litres Per Minute Per Sq. M.	2.7-4.7	2.78	3.07	2.24
Oxygen Consumption cc. Per Minute	199-300	225	223	208
Arterio-Venous Oxygen Difference Volume o/o	2.5-4.7	5.17	4.81	6.30
Total Pulmonary Resistance Dynes Sec. cm^{-5}	100-250	514	821	1627
Pulmonary Arteriolar Resistance Dynes Sec. cm^{-5}	45-100	231	424	775
Work of Right Ventricle Against Pressure Kg. M. Per Sq. M.	0.5-1.0	0.94	1.76	1.61

*Each value represents the Mean of the Group.

TABLE II

MITRAL STENOSIS: EFFECT OF EXERCISE ON HEMODYNAMICS OF TWENTY PATIENTS

	GROUP I (8 Patients)			GROUP II (5 Patients)			GROUP III (7 Patients)		
	Before	After	Change	Before	After	Change	Before	After	Change
Mean Pulmonary Artery Pressure, mm Hg.	*26	33	+7	42	66	+24	67	80	+13
Cardiac Output, Litres Per Minute	4.24	5.89	+1.65	4.33	5.96	+1.63	4.22	4.97	+0.75
Cardiac Index, Litres per Minute per Sq. M.	2.65	3.77	+1.12	2.59	3.58	+0.99	2.53	3.04	+0.51
Oxygen Consumption, cc. per Minute	202	333	+131	200	337	+137	203	324	+121
Arterio-Venous Oxygen Diff. Volume Per cent	4.97	6.18	+1.21	4.85	6.04	+1.19	5.32	6.71	+1.39
Arterial Oxygen Saturation Per cent	90.5	93.1	+2.6	89.8	89.8	0	89.9	89.6	−0.3
Total Pulmonary Resistance, Dynes Sec. cm.$^{-5}$	515	469	−46	831	1037	+206	1387	1355	−32
Work of Right Ventricle Against Pressure Kg. M. per Minute per Sq. M.	0.84	1.54	+0.70	1.37	2.89	+1.52	1.88	3.01	+1.13

*Each value represents the mean of the group.

developed rheumatic fever in the immediate postoperative period, and one developed acute rheumatic fever prior to scheduled operation. In retrospect, it is believed that all three had smoldering rheumatic myocarditis at the time of catheterization. It is suggested that symptoms of shortness of breath, fatigue, etc., might have been due to the developing acute rheumatic state.

Tables III and IV show pre- and postoperative catheterization findings in eight patients. Results of catheterization following mitral commissurotomy are not conclusive because of the small group of patients. Certain trends, however, appear to be significant. In general, patients showing the best clinical results were those who had the greatest drop in pulmonary

TABLE III

RELATIONSHIP OF FALL IN SYSTOLIC PULMONARY ARTERY PRESSURE TO CLINICAL RESULT

1.	E.Y.	60	Chronic Heart Failure
2.	L.M.	45	to
3.	M.C.	29	Normal Activity
4.	J.L.	18	Some Improvement in
5.	C.F.	11	Cardiac Reserve
6.	H.H.	7	Questionable or
7.	R.H.	3	no
8.	M.S.	0	Improvement

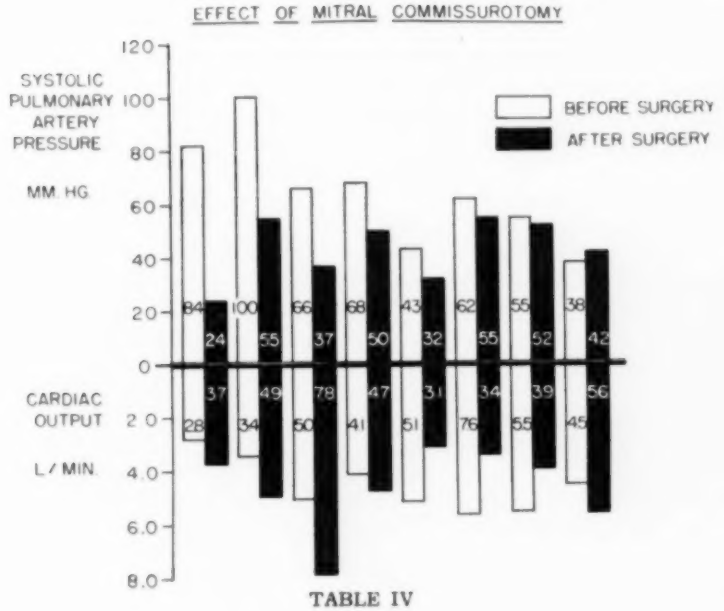

TABLE IV

artery pressure following commissurotomy. Those with an initial pulmonary artery systolic pressure greater than 60 mm./Hg may, following a successful commissurotomy, drop their pressure to one half or less of the former level. These patients show most gratifying results. Patients with initial pressure below 50 mm./Hg often drop their pressure 30 per cent. Their improvement was less dramatic, but definite clinical improvement was present. A small number of those with relatively low pulmonary artery pressures showed no change postoperatively. Their clinical improvement was minimal. No pulmonary artery pressures have thus far dropped to normal levels. However, re-catheterizations have usually been performed three to six months following surgery and the time interval may have been too short to reflect maximal improvement. An increase in cardiac output was the rule in patients with the best clinical result.

It should be emphasized that aside from evaluation by means of cardiac catheterization, the estimation of the degree of disability and altered physiology in a patient with mitral stenosis is extremely hazardous.[10] Evaluation of heart size, electrocardiogram, x-ray, and auscultatory findings either before or after mitral commissurotomy cannot give a true picture of the degree of mitral valve obstruction. Dexter has outlined eight criteria for severe mitral obstruction on clinical grounds[11] which appear to be of value in identifying Group III patients. Those with a lesser degree of disability may need cardiac catheterization for full evaluation of their status. In conclusion it is felt that cardiac catheterization will serve as a very valuable pre- and postoperative yardstick for the estimation of results of mitral commissurotomy.

SUMMARY

1) The resting cardiac output of patients with mitral stenosis is normal, and does not decrease until the onset of heart failure.

2) Pressure levels are more critical than flow levels in estimating the function of the right heart.

3) The most adequate picture of the right ventricular function is obtained from an analysis of pulmonary resistance and of the work of the right ventricle.

4) Patients who are most likely to benefit from mitral commissurotomy are those with high pulmonary artery pressures.

5) The degree of fall of the pulmonary artery pressure following commissurotomy is roughly parallel to the degree of clinical improvement in the few cases studied.

6) Patients with very low pulmonary artery pressures are not benefited by mitral commissurotomy and such low initial pressures may be present in patients with low grade rheumatic myocarditis.

7) Comparison of pre- and postoperative catheterization findings is the only critical method of evaluating results of mitral commissurotomy and should be further pursued.

We wish to acknowledge the technical assistance of Mrs. Helen Obernolte, Dr. Andrew Farr, Miss Mary Mayo and Mr. Lucius Collier.

RESUMEN

1) El rendimiento cardiaco en reposo, en enfermos con estenosis mitral es normal, y no decrece sino hasta el principio de la insuficiencia cardiaca.

2) Para estimar la función del corazón derecho los niveles de presión son de mayor valor crítico que los de flujo sanguíneo.

3) El cuadro mas demostrativo de la función ventricular derecha se obtiene del análisis de la resistencia pulmonar y del trabajo del ventrículo derecho.

4) Los enfermos que mas posiblemente se benefician de la comisurotomía mitral son los que tienen elevadas presiones arteriales pulmonares.

5) El grado de la caída de la presión pulmonar arterial después de la comisurotomía es toscamente paralelo al grado de la mejoría clínica, en los pocos casos estudiados.

6) Los enfermos con muy baja presión arterial pulmonar no se benefician por la comisurotomía y tales presiones bajas iniciales pueden presentarse en enfermos con miocarditis reumatismal de bajo grado.

7) El único método crítico de estudio para valuar los resultados de la comisurotomía mitral es la comparación de los hallazgos de la cateterización antes y después de la operación y aquel procedimiento debe proseguirse.

RESUME

1) Le débit cardiaque des malades atteints de rétrécissement mitral est normal et ne diminue pas tant que n'apparait pas l'insuffisance cardiaque.

2) Pour préciser la fonction du coeur droit, le degré de la pression est un élément de gravité plus important que le taux du débit.

3) Le tableau le plus précis de la fonction du ventricule droit s'obtient en faisant l'analyse de la résistance pulmonaire et du travail du ventricule droit.

4) Les malades qui semblent les plus aptes à bénéficier de la commissurotomie mitrale sont ceux dont la pression de l'artère pulmonaire est élevée. Dans le petit nombre de cas qu'ils ont étudiés, les auteurs ont remarqué qu'il y a un parallèlisme grossier entre la chute de la pression artérielle pulmonaire consécutive à la commissurotomie et l'importance de l'amélioration clinique.

5) Les malades dont la pression de l'artère pulmonaire est très basse ne sont pas améliorés par la commissurotomie mitrale. Des pressions initiales assez basses peuvent exister chez des malades qui ont un certain degré de myocardite rhumatismale.

6) C'est en comparant les résultats du cathétérisme pré- et postopératoire que l'on peut établir la seule méthode d'évaluation des résultats de la commissurotomie mitrale. Ils devront être ultérieurement poursuivis.

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Tibione[†] in the Treatment of Pulmonary Tuberculosis*

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The availability of antibacterial agents capable of inhibiting the growth of tubercle bacilli has altered radically the treatment of pulmonary and extrapulmonary tuberculosis. Streptomycin, discovered by Waksman, Schatz, and Bugie,[1] and tested in vivo by Feldman and Hinshaw,[2] has proved to be an effective antibiotic against tubercle bacilli.

Originally, streptomycin presented definite problems, notably the necessity of administration by multiple daily injections, early development of bacterial resistance and frequent toxic or allergic reactions in the doses employed. Tempel[3] subsequently found that injections of streptomycin every third day or twice a week were as effective as daily injections in the treatment of non-miliary forms of pulmonary tuberculosis. Later, Lehmann[4] reported that para-aminosalicylic acid (PAS) had some value in the treatment of tuberculosis. Through the combined efforts of the Veterans Administration, the Army and the Navy,[5] it was discovered that the daily use of PAS with streptomycin prevented or delayed the emergence of bacterial resistance to streptomycin. PAS, however, frequently produces nausea, vomiting and diarrhea when the recommended daily doses of 8 to 12 grams are employed. The intermittent use of streptomycin and the reduction of standard dosage to one gram per injection has reduced but has not eliminated toxic and allergic reactions.

In the continuous search for other chemotherapeutic agents capable of altering the behavior of tubercle bacilli, Tibione (amithiozone), a thiosemicarbazone, was synthesized by Behnisch, Mietzsch, and Schmidt.[6] The activity of this drug in inhibiting the growth of tubercle bacilli in vitro and in the treatment of experimental tuberculosis was investigated by Domagk.[7] He reported that amithiozone was effective in vitro in dilutions of 1:300,000 or 3 mcg. per ml. of medium. Karlson, Gainer, and Feldman[8] found that tuberculous guinea pigs treated with amithiozone responded in a manner similar to those treated with streptomycin. They also noted that the combination of streptomycin and amithiozone gave better results in the treatment of experimental tuberculosis than either one alone.

Clinical trials of amithiozone, usually under the trade name of Conteben, have been under way in Germany since 1946. The results of these studies have been reported by Kuhlmann and Knorr,[9] Mertens and Bunge,[10] Strum,[11] and others. Following personal investigations in Germany, Hinshaw and McDermott[12] concluded that amithiozone was beneficial in the

[†]"Tibione" is the trade mark of Schenley Laboratories, Inc., brand of amithiozone. Amithiozone is the generic name of the thiosemicarbazones which has been approved by the Council on Medicine and Pharmacy of the American Medical Association. This study was financed in part by a grant from Schenley Laboratories, Inc.

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treatment of tuberculosis and recommended that further studies be undertaken to determine minimum effective doses, toxicity and resistance.

Clinical Investigation

The present study was undertaken in April 1950, in an attempt to determine the clinical effectiveness of amithiozone in the treatment of advanced pulmonary tuberculosis when used in doses limited to 100 mg. daily. It was our further desire to ascertain the toxicity of amithiozone with this dosage when employed over a period of four to six months. This dosage schedule was selected because serious toxic reactions had been reported by Mertens and Bunge,[10] Kuhlmann and Knorr[9] and Kalkoff[13] when 150 mg. to 400 mg. of amithiozone was employed daily.

The method of study is outlined in Table I.

A total of 108 patients were started on treatment with 100 mg. of amithiozone daily. The present status of this group is tabulated in Table II.

The present report is concerned only with those patients who either have completed treatment or were unable to complete therapy due to toxic or allergic reactions. These two groups total 83 patients.

TABLE I: METHOD OF STUDY

1. Preliminary tests—these were completed before instituting treatment with amithiozone. They were repeated at the completion of treatment and repeated again two months later.
   (1) Hematology:
      a. Sedimentation rate
      b. Hematocrit
      c. Complete blood count
   (2) Chemistry:
      a. Bromsulfalein retention
      b. Urinary urobilinogen
      c. Plasma proteins
      d. Thymol turbidity
      e. Cephalin flocculation
      f. Bilirubin
      g. Urinary coproporphyrin
      h. Urea clearance and BUN
   (3) Routine urine examination
   (4) Sputum or gastric culture with sensitivity test
2. During treatment:
   (1) Hemoglobin every week for two months, then every two weeks.
   (2) White blood cell counts every week for two months, then every two weeks.
   (3) Sedimentation rate every two months.
   (4) Urine for albumin and sediment every two weeks.
   (5) Bromsulfalein, urinary urobilinogen and coproporphyrin every month.
   (6) Sputum or gastric cultures with sensitivity tests every two months.
3. Sputum or gastric cultures with sensitivity tests two months and six months after completion of treatment.
4. Roentgenogram of chest at start and every month for nine months.
5. Symptomatic changes including weight, cough, expectoration, and temperature were checked daily or weekly as indicated.

Selection of Patients

It was planned to select patients with extensive pulmonary tuberculosis who had not responded favorably to other forms of therapy, including streptomycin and PAS. In the main, this procedure was followed. Forty-seven of the 64 patients, who form the basis of this report as regards effectiveness of the drug, had far advanced pulmonary tuberculosis and in 17 the tuberculosis was classified as moderately advanced. In 42 the tuberculous lesions were fibrocavernous and these patients would qualify as fair or good "chronics." In the remaining 22, acute or subacute exudative types of lesions were present. The outlook for subjective and objective improvements was best in the latter group. The results of therapy should be interpreted with the knowledge that a majority under treatment had chronic, advanced pulmonary tuberculosis and had not responded favorably to other forms of therapy.

Toxic Reactions

Toxic or allergic reactions, sufficiently severe to necessitate cessation of treatment with amithiozone occurred in 19 (22.9 per cent) of 83 patients. These reactions are listed in Table III. The total number of reactions in Table III is greater than the number of patients with reactions because some exhibited multiple reactions.

All of the toxic and allergic reactions subsided rapidly with early recognition and prompt withdrawal of the drug. The hematopoietic and gastro-intestinal systems were affected most frequently. The development of agranulocytosis in one patient is illustrated in Figure 1.

TABLE II

PRESENT STATUS OF 108 PATIENTS TREATED WITH AMITHIOZONE

1. Completed 4 to 6 months of prescribed treatment	64
2. Treatment discontinued because of toxic reactions	19
3. Prescribed treatment continuing but not completed	1
4. Treatment discontinued for reasons other than toxicity	16
5. Died	8

TABLE III: REACTIONS NECESSITATING DISCONTINUATION OF AMITHIOZONE IN 19 PATIENTS

1. Hematopoietic system		7
(1) Progressive anemia	5	
(2) Granulocytopenia	1	
(3) Agranulocytosis	1	
2. Gastro-intestinal system		14
(1) Persistent nausea	4	
(2) Nausea and vomiting	2	
(3) Severe anorexia	8	
3. Hepatic system		2
(1) Serious bromsulfalein retention	2	
4. Recurrent allergic dermatitis		3
5. Drug fever		2

Hepatic toxicity was suspected in two patients because of changes in the bromsulfalein test. One with 7 per cent retention in 45 minutes at the onset of treatment demonstrated 52 per cent retention of bromsulfalein after three months of therapy. Amithiozone was then stopped and hepatic insufficiency was confirmed by additional tests of liver function. The second had an initial level of 17.5 per cent retention of bromsulfalein. This rose to 40 per cent in one month, at which time amithiozone was discontinued. The same patient also exhibited a rapidly progressive anemia. Detectable jaundice did not develop in either patient.

Dermatitis and drug fever were proved to be due to amithiozone by improving on withdrawal of the drug and re-appearing on re-institution of treatment.

Laboratory Data in Completed Cases

As shown in Table II, 64 patients completed four to six months of treatment with amithiozone. Of these, seven were treated for four or five months, and the remainder received six months of therapy.

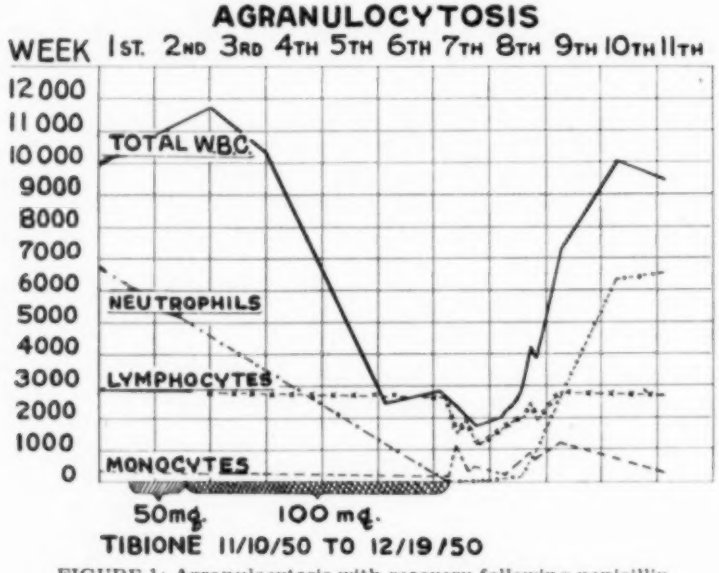

FIGURE 1: Agranulocytosis with recovery following penicillin and blood transfusions.

TABLE IV

AVERAGE CHANGES IN HEMOGLOBIN CONCENTRATION

1. Average hgb. concentration prior to treatment	14.0 gm.
2. Lowest average level during treatment	11.9 gm.
3. Average hgb. concentration at completion of treatment	13.1 gm.
4. Average hgb. concentration 2 months later	14.5 gm.

Average hemoglobin concentrations dropped 2.1 grams during treatment but partial recovery occurred spontaneously so that the average loss in hemoglobin concentration was 0.9 gram at the conclusion of therapy. Changes in hemoglobin concentrations are shown in Table IV.

Moderate reductions in total white blood cells developed during treatment but, again, spontaneous recoveries occurred, while therapy was continued, almost to pretreatment levels. The reductions, in the main, were due to relative and absolute decreases in the number of neutrophiles. Changes in total white blood cell counts are recorded in Table V.

Sedimentation rates, as measured by the Westergren method and read at one hour, revealed an average reduction from 36 mm. to 30.4 mm. These findings are probably of limited significance since the apparent average improvement did not occur regularly and individual variations were marked. Although 36 patients exhibited decreases in sedimentation rates, 25 others revealed increases and three demonstrated no changes. The variations in sedimentation rates are shown in Table VI.

Determinations of bromsulfalein retention in 63 patients prior to treatment indicated some impairment of hepatic function in 17. Retention of bromsulfalein greater than 5 per cent was demonstrated in these patients; and in nine of them it was more than 10 per cent. These findings were confirmed by additional tests of hepatic function, as outlined in Table I.

During treatment with amithiozone, retention of bromsulfalein increased, as shown in Table VII. Although treatment was continued, levels subsequently decreased and at the conclusion of therapy average levels of retention of bromsulfalein were slightly lower than those obtained prior to treatment.

TABLE V

ALTERATIONS IN TOTAL WHITE BLOOD CELL COUNTS

1. Average pretreatment (range 5,150 to 14,800)	8,686
2. Average lowest count during treatment (range 3,800 to 11,850)	6,527
3. Average at completion of treatment (range 3,850 to 17,050)	8,279
4. Average two months later (range 4,500 to 13,150)	8,109

TABLE VI

VARIATIONS IN SEDIMENTATION RATES

1. Average pretreatment (range 2.5 mm. to 124 mm.)	36.0 mm.
2. Average at completion of treatment (range 4.0 mm. to 138 mm.)	30.4 mm.
3. Average two months later (range 1.0 mm. to 133 mm.)	29.5 mm.

TABLE VII

RETENTION OF BROMSULFALEIN IN 63 PATIENTS

1. Average retention prior to treatment (1 to 17.5 per cent)	4.9 per cent
2. Average peak retention during treatment (2 to 35.0 per cent)	8.4 per cent
3. Average level at completion of treatment (1 to 13.5 per cent)	4.2 per cent
4. Average level two months later (0.5 to 20.5 per cent)	4.3 per cent

Twenty patients demonstrated retention of bromsulfalein greater than 10 per cent during treatment as compared to nine demonstrating such levels prior to therapy.

Symptomatic Changes

A) *Weight.* Records of changes of weight were adequate in 59 of the 64 patients who completed treatment with amithiozone. Forty (67.8 per cent) gained an average of 10.2 pounds during the four to six months of therapy. Eighteen (30.5 per cent) lost an average of 3.3 pounds. The weight of one remained unchanged.

B) *Cough.* Forty-eight of 64 patients were coughing when treatment was instituted. Improvement in severity of cough was noted by 21 (43.7 per cent). The improvement was classified as moderate or marked in 15 of the 21. The remaining 27 reported their cough as unchanged.

C) *Expectoration.* Forty-four patients had expectoration of sputum at the institution of therapy. Twenty-two (50 per cent) noted favorable changes in the quantity of sputum and in 19 of these the favorable changes were considered moderate or marked. However, six of the remaining 22 reported an increase in quantity of expectoration and in four of the six the increase was classified as moderate or marked.

D) *Fever.* Six patients consistently ran fever above 100 degrees F. prior to therapy. In four of them reduction of fever to normal levels occurred. The changes in patients whose fever did not exceed 100 degrees F. were too slight to be considered significant.

TABLE VIII: ROENTGEN CHANGES AT COMPLETION OF TREATMENT WITH AMITHIOZONE

1. Improvement		40 (64.5 per cent)
(1) Slight	18	
(2) Moderate	17	
(3) Marked	5	
2. No important changes		18 (29.1 per cent)
3. Worsening		4 (6.4 per cent)
(1) Slight	3	
(2) Moderate	1	
(3) Marked	0	

TABLE IX: ROENTGEN COMPARISONS SIX MONTHS AFTER COMPLETION OF TREATMENT WITH ROENTGENOGRAMS TAKEN AT COMPLETION OF TREATMENT

1. Further improvement		10 (20.8 per cent)
(1) Slight	9	
(2) Moderate	1	
(3) Marked	0	
2. No further important change		26 (54.2 per cent)
3. Worsening		12 (25.0 per cent)
(1) Slight	6	
(2) Moderate	5	
(3) Marked	1	

Roentgen Changes

Roentgenograms taken at the completion of therapy were compared with initial examinations in 62 patients.

Comparisons were not satisfactory in two others because pulmonary resection obscured any changes. The results of these examinations are tabulated in Table VIII.

Twenty-two (35.4 per cent) of the 62 patients demonstrated moderate or marked roentgenographic improvement at the completion of treatment. Only one (1.6 per cent) showed moderate or marked worsening, although the roentgenograms in three others revealed slight progression.

Forty-eight were re-examined roentgenographically six months after treatment was completed. These roentgenograms were compared with those taken at the completion of therapy. The results are outlined in Table IX.

Follow-up roentgenograms six months after completion of treatment indicated that relapses had developed in 12 patients and the unfavorable changes were interpreted as moderate or marked in six of them.

TABLE X: CHANGES IN RECOVERY OF TUBERCLE BACILLI BY EXAMINATION OF SMEARS AFTER SIX MONTHS OF TREATMENT

1. Positive smears at start of treatment			40
(1) After treatment	(a) Positive	28	
	(b) Negative	10	
	(c) No sputum	2	
2. Negative smears at start of treatment			17
(1) After treatment	(a) Positive	3	
	(b) Negative	11	
	(c) No sputum	3	
3. No sputum at start of treatment			7
(1) After treatment	(a) Positive	1	
	(b) Negative	0	
	(c) No sputum	6	

TABLE XI: CHANGES IN SMEARS OF SPUTUM SIX MONTHS AFTER COMPLETION OF TREATMENT

1. Positive smears at start of treatment			33
(1) Six months after completion of treatment:			
	(a) Positive	24	
	(b) Negative	7	
	(c) No sputum	2	
2. Negative smears at start of treatment			13
(1) Six months after completion of treatment:			
	(a) Positive	4	
	(b) Negative	8	
	(c) No sputum	1	
3. No sputum at start of treatment			7
(1) Six months after completion of treatment:			
	(a) Positive	0	
	(b) Negative	1	
	(c) No sputum	6	

Recovery of Tubercle Bacilli

A) *Sputum smears.* Tubercle bacilli (acid-fast bacilli) were demonstrated by examinations of smears in 40 of 57 patients prior to therapy. Tubercle bacilli could not be identified by study of smears in the remaining 17. Seven additional patients raised no sputum.

Changes which developed in these groups following therapy are shown in Table X.

Favorable changes by this method of study were noted in 12 (30 per cent) of the 40 patients in whom tubercle bacilli were identified by examinations of smears before treatment. On the other hand, four of 24 who had no sputum or were negative by study of smears became positive during treatment.

Similar examinations of smears were available in 47 patients, six months after treatment with amithiozone was completed. The results are tabulated in Table XI.

Favorable effects found at the completion of therapy generally persisted six months after therapy was ended. However, one additional patient who had previously been negative by examination of smears turned positive.

B) *Sputum or Gastric cultures.* Recovery of tubercle bacilli by cultural methods is known to be more accurate than examinations of smears and the results are, therefore, more significant.

Sputum or gastric cultures were interpreted as positive for tubercle bacilli in 62 patients, prior to therapy with amithiozone. Similar examinations were available in 61 patients at the completion of treatment. Sixteen (26.2 per cent) of these cultures revealed no growth of tubercle bacilli.

Sputum or gastric cultures were studied again six months after completion of therapy in 50 patients. Twenty (40 per cent) showed no growth of tubercle bacilli.

Examinations of sputum or gastric cultures indicated that 26.2 per cent of the patients studied had converted from positive to negative at the completion of treatment. Similar studies six months later revealed that 40 per cent of the patients had become negative by this method of study.

Resistance

Tests for sensitivity were performed on organisms from 86 cultures prior to institution of treatment with amithiozone. Seventy-eight were interpreted as completely sensitive in that growth of tubercle bacilli was totally inhibited in dilutions containing 1 mcg. of amithiozone per ml. of medium. Tubercle bacilli from the remaining four cultures apparently demonstrated partial resistance in that growth was present in tubes containing 5 mcg. of amithiozone per ml. Bacilli from four other cultures appeared to be completely resistant in that tubercle bacilli were able to grow as luxuriantly in tubes containing 5 mcg. of amithiozone per ml. as in the control tubes and growth was also present in tubes with 10 mcg. of amithiozone per ml. Five of the eight cultures demonstrating partial or complete resistance were retested and four were found to be completely sensitive.

Twenty-eight examinations for sensitivity were performed following three

months of treatment. Five (17.8 per cent) were found to be partially or completely resistant.

At the completion of six months of therapy, 47 examinations for sensitivity were performed. Twenty-two (46.8 per cent) were reported to be partially or completely resistant. The majority of these were completely resistant.

Thirty-six examinations for sensitivity, performed two to three months after cessation of treatment, revealed 12 (33.3 per cent) showing partial or complete resistance.

Ten (29.4 per cent) of 34 similar studies, four to six months after therapy was completed, demonstrated partial or complete resistance. These results appear to indicate that sensitivity is re-acquired in some cases after amithiozone is discontinued.

Comment

Amithiozone in doses of 100 mg. per day and employed for four to six months has proved to be moderately effective in patients with advanced pulmonary tuberculosis. These favorable effects often are temporary, indicating that the duration of treatment may need to be more prolonged or accessory measures should be added during the period of treatment with amithiozone.

Amithiozone is by no means as potent an anti-tuberculosis agent as streptomycin combined with PAS. However, amithiozone may be employed in patients whose organisms are resistant to streptomycin or in whom streptomycin is not tolerated because of toxic or allergic reactions. Amithiozone may also be recommended as supplemental therapy when the response to streptomycin and PAS is not satisfactory.

Serious toxic or allergic reactions remain important problems even when daily doses are reduced to 100 mg. Repeated laboratory examinations are essential and should include, as a minimum, frequent determinations of hemoglobin concentrations and total white blood cells as well as tests for liver function. The tendency to progressive anemia, granulocytopenia and toxic hepatitis demands careful observation of every patient under treatment.

Moderate or marked decrease in the severity of cough and reduction in quantity of sputum was noted in 30 to 40 per cent of the patients treated. Gains of weight, averaging 10.2 pounds, occurred in approximately 65 per cent of the patients treated with amithiozone. Four of six patients with fever greater than 100 degrees F. reverted to normal temperatures.

Roentgenographic evidences of moderate or marked improvements were demonstrated in approximately 35 per cent of the patients but there was a tendency to relapse in the six-month period following completion of treatment.

Sputum or gastric cultures for tubercle bacilli converted from positive to negative in 26 per cent. These favorable effects were enhanced further six months after therapy was completed in that 40 per cent of the cultures which were positive at the onset of treatment had become negative.

Resistance to amithiozone develops in nearly half of the patients after six months of treatment with amithiozone alone. Sensitivity is re-acquired in some patients two to six months after therapy is completed.

SUMMARY

Amithiozone (Tibione) in doses of 100 mg. daily for four to six months, has demonstrated definite but limited benefit in the treatment of patients with advanced pulmonary tuberculosis. Toxic reactions, including progressive anemia, granulocytopenia and toxic hepatitis, occur with sufficient frequency to limit its usefulness and necessitate frequent laboratory examinations. Amithiozone is not as effective as streptomycin with PAS and its use should be limited to patients whose organisms are resistant to streptomycin and PAS or where streptomycin and PAS cannot be employed because of toxic or allergic reactions. Resistance to amithiozone develops frequently following six months of treatment.

RESUMEN

La amitiozona (Tibione) a las dosis de 100 mg. diarios por un periodo de cuatro a seis meses ha demostrado ser de un beneficio definido pero limitado en el tratamiento de enfermos con tuberculosis pulmonar avanzada. Las reacciones tóxicas tales como anemia progresiva, granulocitopenia y hepatitis tóxica se observan con suficiente frecuencia como que se considere su limitada utilidad y se necesiten frecuentes éxamenes de laboratorio. La amitiozona no es tan efectiva como las estreptomicina con PAS y su uso debe restringirse a los enfermos cuyos gérmenes son resistentes a las estreptomicina y el PAS o cuando estas dos drogas no puedan emplearse a causa de reacciones tóxicas o alérgicas. La resistencia a la amitiozona se presenta frecuentemente después de seis meses de tratamiento.

RESUME

L'amithiazone (Tibione) aux doses de 100 mmgr. par jour pendant quatre ou six mois a un effet précis, mais limité dans le traitement des malades atteints de tuberculose pulmonaire avancée. La fréquence des réactions toxiques, avec anémie progressive, agranulocytose et hépatite toxique limite son utilisation et nécessite de nombreux examens de laboratorie. L'amithiazone n'a pas autant d'efficacité que la streptomycine associée au P.A.S. et son emploi devrait être réservé aux malades dont l'organisme est résistant à la streptomycine et au P.A.S., ou lorsque la streptomycine et le P.A.S. ne peuvent être employés à cause de réactions toxiques ou allergiques. La résistance au produit se développe fréquemment après six mois de traitement.

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Domiciliary Treatment of Pulmonary Tuberculosis

The Seton Hospital Home Care Program*

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Hospitalization is the most effective single measure in the control of tuberculosis for the individual as well as the community, but there are a number of obstacles preventing institutional treatment during the entire course of the illness. Foremost is the fact that in New York City, and undoubtedly other sections of the country, many more patients are found in need of hospitalization than are beds available. Case finding programs in health and diagnostic clinics, in schools, colleges and industry, are bringing to light large numbers of persons with symptomless tuberculosis. Routine roentgenography of hospital admissions is particularly fruitful in this respect although, as yet, this method of tuberculosis case finding has hardly been explored.

In New York City the tuberculosis problem is especially acute because of the influx in recent years of thousands of Negroes and Puerto Ricans. Moreover there is an increasing demand for hospitalization on the part of the patients in contrast to former years when they were very much averse to entering institutions. The readier acceptance of hospitalization is partly due to the fact that measures are now available which give tuberculous patients excellent chances for recovery providing the disease is treated in time. The various factors mentioned, as well as the prolongation of life of patients by modern treatment who otherwise would have succumbed early to the disease, have been instrumental in overloading hospital facilities, inadequate at best. The result has been the enforced retention at home and in the community of many individuals with active pulmonary tuberculosis, thereby creating new foci of infection and disease.

To help meet the serious bed shortage for tuberculous patients in New York City, but more specifically to test a new approach to the problem, a Home Care Program was instituted at Seton Hospital in 1950. The program is designed to shorten the period of hospitalization of a select group of patients in order that more can be admitted to the institution. At the same time every precaution is taken not to jeopardize the health of the individual by premature transfer to home care. The aim is to use the hospital bed more judiciously for the greatest good of the largest number. Home care is based on the premise that at some time during the long-term treatment of the average patient with pulmonary tuberculosis the home,

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under certain conditions, also has a place. It stands to reason that the placement of a patient on home treatment depends not only on specific medical indications but also on other considerations involving the joint efforts of various health agencies.

Indications and Contraindications for Home Care

Patients suitable for Home Care fall into one of three major groups:

1) Medical Cases: This group includes patients treated by the conventional rest regimen and antibacterial agents. The disease appears to be regressive and there is reasonable expectation that in time it will become arrested. Before transfer is made to home care, the sputum is negative on concentrate for at least three months, except for an occasional positive culture. However, we find since the introduction of antibacterial agents (streptomycin, para-aminosalicylic acid and isoniazid) that sputum findings are no longer dependable criteria. Too often "negative" sputum is obtained in the presence of clearly demonstrable cavities. The bacteriological results have therefore lost much of their significance in the assessment of the status of a tuberculous process. The chest x-ray film, especially tomography in the posterior-anterior and lateral projections, is assuming much more importance in patients under antibacterial medication.

2) Pneumothorax and Pneumoperitoneum Cases: The group consists of patients under effective pneumothorax and pneumoperitoneum treatment. The patients are placed on home care as soon as the disease is under control. Refills are given at the hospital.

3) Surgical Cases: After a patient has recovered from the effects of a major operation such as a lobectomy, pneumonectomy or thoracoplasty, home care is considered. One does not wait for arrest of the disease and conversion of the sputum since this takes months, often years. It is well known that patients may eliminate acid-fast organisms, on occasion, long after a successful operation. A decided tendency toward healing after a technically satisfactory operation and suitable home conditions are the major indications for home care. In this respect indigent patients are given the same consideration as the well-to-do who, after an operation in a private hospital, are sent home to complete their convalescence. In some respects indigent patients with pulmonary tuberculosis fare better than the more affluent; the latter may get better personal service but the former are more apt to get better treatment of their disease.

The interval between operation and transfer to home care ranges for the surgical patients from six weeks to four months; in exceptional cases, six months. Of late, our tendency has been to shorten the hospital stay following successful operation. Our most gratifying results have been obtained in this group. It need only be mentioned that the final decision rests on the patient's clinical condition (Table I).

The types of patients not suited for home care are individuals with progressive disease requiring constant medical or nursing care and obviously, those with open cavities and persistent tubercle bacilli in the sputum. Patients in need of active measures in the way of surgical treatment or

involved diagnostic procedures are kept in the hospital. Home care is not used for custodial types of patients with chronic fibroid tuberculosis. Patients with long-standing fibroid tuberculosis who have had all the possible benefits of active therapeutic measures, should be treated in custodial institutions. The results obtained from institutional treatment of such patients do not justify prolonged occupancy of precious hospital beds.[1] Such patients do not fit into home care program since they are in a condition to visit periodically local clinics. Inasmuch as such individuals are apt to spread infection in the community, the need of custodial institutions is most pressing. The need will probably become greater in the immediate future for reasons to be discussed presently.

In the past two years a number of patients have been readmitted to the hospital from home care for various diagnostic and therapeutic procedures; quite a few for major surgery (Table II). As to the latter, the reasons are quite understandable. It has been our experience that occasionally a patient or the family of a patient, in the case of a minor, will not consent to a diagnostic procedure such as bronchoscopy, let alone major surgery. When the subject of an operation is broached, such patients immediately make plans to sign out against advice. At other times, the medical staff may feel the need of a test period before subjecting a patient to a major operation. In either event the patient is placed on home care usually with little trouble. After a variable period, the patient often becomes more cooperative and is persuaded to reenter the hospital for completion of treatment.

TABLE I

PATIENTS TRANSFERRED TO HOME CARE

	March 1 to February 28	
	1950-51	1951-52
1. Medical	59	62
2. Pneumothorax and pneumoperitoneum:		
Pneumothorax	6	16
Pneumoperitoneum	19	10
Pneumothorax and pneumonolysis	7	0
3. Surgical:		
Thoracoplasty	17	7
Thoracoplasty and decortication	2	1
Thoracoplasty and scapulectomy	1	0
Thoracoplasty and scapulectomy, thoracoplasty, revision	1	0
Lobectomy	11	19
Lobectomy and thoracoplasty	6	8
Pneumonectomy	0	2
Pneumonectomy and thoracoplasty	9	4
Pneumonectomy and pleurectomy	0	2
Decortication	1	1
Extrapleural pneumothorax	0	1
Extrapleural pneumothorax and thoracoplasty	1	0
Thoracotomy	0	1
Pneumonolysis and thoracotomy	0	1
TOTAL	140	135

In medical problem cases, the staff may, after a few months, become more convinced of the indications of a particular line of treatment. Home care therefore serves a useful function in both respects. It should be noted that of the 58 patients sent back to the hospital, only 14, or less than 5 per cent, of the 276 on the home care program in the past two years were readmitted because of reactivation or possible reactivation of the disease. In some cases it was only a matter of finding acid-fast bacilli on culture previously negative. In view of the nature of the material, the incidence of relapse is exceptionally low.

At a recent medical-surgical conference, the case histories were presented of all patients readmitted to the hospital for surgical treatment. The purpose was to determine whether or not any had been placed on home care prematurely. To the satisfaction of the entire staff, not a single instance was found where an operation could have been done before the patient had been placed on home care. In the majority, either the patient did not consent to surgical treatment and had intended to sign out against advice or the condition was such as to preclude surgery at the moment. Several were readmitted for treatment of extrapulmonary or nontuberculous surgical conditions. The following thumbnail sketches are illustrative:

S.P., refused surgery in the hospital; placed on home care with the understanding that she might have to return later for additional treatment; returned to the hospital and had right upper lobectomy.

S.B., had pneumoperitoneum; placed on home care; later brought back to the hospital for surgery.

H.K., placed on home care to prevent his signing out A.O.R., later returned to hospital and had left upper lobectomy.

J.C., placed on home care with the plan to present later to conference for surgery; returned and had extrapleural thoracoplasty.

K.C., placed on home care to prevent her signing out A.O.R.; readmitted to the hospital three months later and had right lower lobectomy.

E.L., placed on home care during summer to await surgery in the fall; read-

TABLE II

REASONS FOR TRANSFER FROM HOME CARE TO HOSPITAL

	March 1 to February 28	
	1950-51	1951-52
Surgery	3	11
Possible surgery	0	2
Bronchoscopy	5	9
Pneumothorax	2	1
Pneumoperitoneum	1	1
Streptomycin	2	2
Penicillin	1	0
Reactivation or possible reactivation	4	10
Swollen joints	1	0
Economic and social reasons	1	2
TOTAL	20	38

mitted but bronchoscopy revealed endobronchial disease; transferred back to home care with the plan of readmission on a future occasion.

D.F., placed on home care to prevent her signing out A.O.R.; readmitted six weeks later and underwent a three-stage thoracoplasty.

H.N., had lobectomy and placed on home care; five months later had positive gastric cultures; readmitted and had a thoracoplasty.

D.M., had thoracoplasty; transferred to home care with knowledge of the possible presence of a cavity on the operative side; readmitted to the hospital and left upper lobectomy done; transferred back to home care.

Home Care and Out Patient Care

The patient on home care differs from one in the out patient department in several respects. The former is a ward patient temporarily cared for at home. The disease is still unstable and the individual requires close supervision. Home care physicians, nurses and social workers visit the patient at home at frequent intervals. For special procedures such as radiography, bronchoscopy and involved laboratory procedures, the patient is brought by vehicle to the hospital and returned by vehicle.

The out patient department case is one in whom the disease is arrested. A periodic check-up is required on an ambulatory basis. The time interval between visits to the clinic may vary from three to six weeks, except for those receiving collapse treatment. It is our belief that comparatively few patients at Seton Hospital with pneumothorax or pneumoperitoneum are eligible for refills in the out patient department in less than six months of the institution of such treatment. The main reason is because many of our patients are young Negroes and Puerto Ricans from the poorer sections of the city in whom tuberculosis is a serious disease and relapse is common. The majority need a period of gradual adjustment, otherwise they are apt to break down and undo all the good work that has been done. For such patients a short period on home care is necessary before transfer to the out patient department. The hospital, home and out patient department are used interchangeably. The availability of these facilities serves to keep the patient under stricter control.

Management of Home Care Patients

The determination of the suitability of the home care is the joint responsibility of the public health nurse and the home care coordinator, the latter also being a qualified medical social worker. Consideration is given to the number of rooms, the number and age of the occupants, cleanliness, ventilation, the presence of a family member or friend to care for the patient and the various factors which are conducive to proper supervision and treatment of a patient at home. The financial status of the family is investigated and aid is sought through the department of welfare to remedy deficiencies. All members of the family, including the children, are examined roentgenologically prior to transfer of the patient to home care. Children are placed with relatives or in a preventorium if accommodations can be arranged. The department of health may administer BCG if this measure is indicated.

Upon transfer to home care, the patient's regimen is outlined by the physician in charge of the home care service. It may be mentioned at this point that we have found it indispensable to have a permanent home care medical unit assigned to this work. A home care coordinator integrates the work of the medical staff and the various social and welfare agencies. Home visits are made by a resident physician and periodically by a home care visiting physician. At specified periods conferences are held at the hospital at which time the physicians make recommendations as to lines of treatment and special examinations indicated.

At the initial home visit, the home care coordinator studies the attitude of the family and its willingness and ability to care for the patient, as well as the physical facilities available. A separate bed is secured. The family is instructed in various hygienic procedures. Subsequent visits by the department of health nurse and the home care service determine the cooperativeness of the patient and family. Special attention is given to methods of sputum disposal. Patients selected for home care are semi-ambulant, intelligent and able to take care of their personal needs.

After selection at medical conference for home care, each patient receives orientation talks from the coordinator, the physician in charge and the hospital administrator. Once monthly, more often if necessary, the record of each patient is reviewed by one of the physicians on the home care service. This review includes x-ray film and laboratory work, special examinations, social case work and the patient's ability to participate in occupational therapy and rehabilitation. At this time recommendations are made for the patient's continued care at home or discharge to the patient's physician, clinic or Seton Hospital out patient department, or, if necessary, readmission to the hospital. It should be emphasized that the individual on home care is considered a patient on the active register of the hospital and is entitled to all of the services and facilities of the institution. An average of 60 patients are maintained currently on home care, an addition of 13 per cent to the hospital census.

The home care record is attached to the patient's hospital chart. It contains pertinent information on special forms, including (1) the clinical history, and the opinions of the physicians of the visiting and home care services; (2) subsequent decisions of the staff as well as memoranda of social case workers and of the department of health nurse; (3) home care medical reviews of the case; (4) visits, examinations, progress notes and laboratory reports; (5) records of the later course of events relative to (a) reasons for readmission to the hospital or (b) discharge from home care to other facilities.

The administrative responsibility of the hospital follows the patient to the home. Transportation to and from the hospital is provided by a hospital vehicle. Should an emergency arise, the deputy medical superintendent arranges for immediate readmission to the hospital. Such readmissions receive priority over the waiting list. If necessary, transfer is made to the nearest municipal general hospital. Patients are instructed to call the home

care coordinator during the day or the nursing supervisor at other times, if necessary. Such calls are received on a 24 hour schedule.

The department of health is informed when a patient is transferred to home care. Often the department of welfare, already assisting the family, must include the additional member in the home budget for food, clothing and other necessities. The home care patient may mean a new addition to this department. The department of education, division of handicapped children, may be called upon to give home instruction so that the school work may be adjusted to a child's needs and medical condition. The New York City Housing Authority is often asked to consider a family's need for rehousing. In every instance at least one, and in most cases two or more, local agencies participate in the effort. The list of public and private agencies cooperating in the Seton Hospital home care program is too long to enumerate. Suffice it to say that a patient's transfer to home care sets into motion new or renewed community relationships and services.

An index of the volume of work performed by the home care service is shown in Table III. The quality of the personalized service cannot be translated in tabular form. The number of doctor's visits to the home approximates one every 16 days. The single death of a patient on home care in the past two years was due to coronary thrombosis.

Rehabilitation

During the time the patient is on home care and is approaching the stage of arrest of the disease, thought is given to his return to a gainful occupation. When on low activity, the occupational therapy department supervises the needs; later the rehabilitation department takes over. In combined conferences, the physician in charge of the home care program and the physician supervising rehabilitation, as well as other representatives of home care, occupational therapy, social service and the directors of recreation and education, plan a course for the near and distant future. Activities are stepped up depending on the patient's condition. The patient

TABLE III

HOME CARE SERVICES OVER A TWO YEAR PERIOD

	March 1 to February 28	
	1950-51	1951-52
Number of patients transferred to Home Care	140	135
Number of repeated transfers	16	28
Total number of transfers to Home Care	156	163
Total number of Home Care days	13,693	19,940
Doctor visits to Home Care patients	884	1,327
Coordinating Nurse visits	573	919
Disposition of Home Care patients:		
To Out Patient Department	84	108
To Hospital	20	38
To Physician	1	0
Died	0	1

is tested for aptitudes and skills and is given training consistent with his or her educational or work experience background. Teachers are provided when necessary and the cooperation of agencies identified with rehabilitation of the tuberculous is solicited. Rehabilitation supervision continues until the placement of a patient in suitable work activity.

Preferential Admission of Prospective Home Care Patients

A parallel development of the home care program, but an essential one, is the obtainment of patients who would most likely benefit by such a service. A plan has been worked out, in cooperation with the Special Hospital Facilities Service of the Department of Hospitals, whereby the pertinent records and x-ray films of patients on the Seton Hospital waiting list, who might be potential candidates for home care, are screened relative to the status of their pathological diseases prior to their admission. Those who qualify receive preferential admission. Obviously, patients acceptable are those with disease amenable to definitive measures. Before a patient is placed on the preferential list, the social case worker determines whether home conditions are suitable for the later use of the home as an adjunct to the treatment. Patients selected for preferential admission approximate 20 per cent of the total hospital admissions.

The procedure of admission and the processing of patients involves the Special Hospital Facilities Service, the home care coordinator and the home care medical staff. All applications for Seton Hospital clear through the Special Hospital Facilities Service. The application forms, x-ray films and other clinical data available are procured for review by the Seton Hospital staff. The home care coordinator is personally responsible to see that preferential admission is made solely on the basis of relative urgency with reference to early utilization of the home care program. A number of precautionary measures have been taken to insure anonymity of the applicant. To date we have not had a single complaint that favoritism has been shown in the selection of patients for preferential admission in spite of the fact that the hospital is attracting increasing numbers of patients.

Discussion

The home care program for the tuberculous at Seton Hospital is an outgrowth of the home care program of the department of hospitals of the City of New York, initiated in the latter part of 1948. By 1951, 16 of the municipal hospitals were providing a total of nearly 665,000 patient days at home, representing a 10 per cent increase in the facilities of these institutions. In the 1951 annual report of the department of hospitals,[2] Dr. Marcus D. Kogel, Commissioner of Hospitals, estimated that without the home care program the general hospitals would have had to take care of an additional number of patients which would have increased the average occupancy rate of the general wards from 97.1 to approximately 113 per cent. Inasmuch as one out of every four patients cared for on the wards of the municipal hospitals is a tuberculosis patient, it is obvious that an expansion of the home care program for the tuberculous is most desirable.

However, in the utilization of home care, patients with pulmonary tuberculosis present special problems because the disease is infectious and contagious, a major point of difference with other chronic diseases which make up the bulk of home care patients. However, it is our considered opinion that a home care program for the tuberculous can be maintained with adequate protection of public health.

The home care program for the tuberculous rests on the assumption that an intelligent and cooperative patient, partially restored to health in an institution and who might be expected to recover in due time, can be taken care of for a part of his long-term illness at home. Patients who have gone through a period of active treatment, often including surgical measures, sooner or later begin to feel that the hospital has little more to offer than bed rest. Many sign out against medical advice because of restlessness and boredom after many months of confinement. Home care serves a useful purpose at this critical juncture.

Recent advances in the diagnosis and treatment of tuberculosis make home care an important therapeutic modality and to some extent indispensable. Current measures tend to convert an active, progressive disease into a more or less chronic illness; the latter often becoming a "life-long" problem. As mentioned previously, antibacterial medication, especially with the recently introduced isonicotinic acid hydrazides, serves in many instances simply to improve the patient through the symptomatic effects of the drugs. The individuals are left with chronic pulmonary tuberculosis. Greater use of antibacterial agents and surgical measures will undoubtedly continue to hasten the natural decline of tuberculosis which began at the turn of the present century. But there is still much to be done. Refined methods of bacteriological diagnosis indicate that it takes years before a cure is oftained during which time relapse may occur.

In addition, case finding methods through routine roentgenography, if intensified among hospital and clinic admissions, particularly among indigent and tuberculosis-vulnerable groups of the population, showed result in the immediate future in the finding of greater numbers of individuals with symptomless tuberculosis. These will require immediate segregation and treatment. The several factors mentioned will create in the coming years an even greater need for hospital beds. In an illuminating study, Drolet and Lowell[3] point out that tuberculosis mortality has been declining at an accelerated rate, especially during the past few years. On the other hand, tuberculosis morbidity has tended to remain on a high level and the majority of new cases of tuberculosis are still in an advanced stage when first discovered.

An expansion of the home care program is an additional method of handling the tuberculosis situation, although it is by no means the ideal and serves only a small segment of the tuberculous. In addition to home care there is also great need for institutions where patients with fibroid phthisis can obtain custodial care. Such institutions should be integrated with hospitals for the tuberculous where active therapeutic measures are

immediately available. Home care completes a unified therapeutic triad. From the viewpoint of public health, it stands to reason that it is less hazardous to treat a patient at home who knows the nature of his disease and is well on his way to recovery than it is to have a newly discovered individual with active tuberculosis at large waiting for a hospital bed to become available. The individual as well as the public is best served by a well integrated home care program. But it should be emphasized that any benefit accruing to the public, as the result of such an agency, depends on the quality of care which the individual receives.

Effective utilization of a home care program increases substantially the services rendered by a hospital to the community, whether it be a tuberculosis or a general institution. The principles are the same. A home care program permits more beds to become available for new patients; at the same time, the increased turnover reduces the waiting list. This results in earlier and more effective control of the disease. In the younger age groups, in which tuberculosis wreaks its greatest havoc with each day's delay, early admission may spell the difference between cure and death. Inasmuch as the more advanced the disease the longer it takes to effect a cure, if at all, earlier admission of patients serves in itself to shorten the hospital stay.

Dr. Eli H. Rubin estimates that between 10 and 15 per cent of the patients of a large municipal tuberculosis hospital, such as Seton, can be effectively treated on home care.[4] The bed capacity of Seton Hospital is 450 and the number of patients on home care ranges between 50 and 60, approximately the percentage estimated. If a similar proportion of patients were on home care in other large tuberculosis services in the department of hospitals, the total number of tuberculosis patients on home care would equal the bed capacity of a sizable hospital, at a fraction of the cost of constructing and maintaining such an institution. Obviously, hospitals for the tuberculous catering to patients with less advanced disease or to patients of a higher economic level, may be able to have a greater proportion of patients on home care.

The urgent need of reducing tuberculosis hospital waiting lists is being felt in other parts of the United States as well as in the United Kingdom. At a symposium on "Problems Arising When Home Care of the Tuberculous is Necessary," held at the 1951 annual meeting of the National Tuberculosis Association, the participants discussed various aspects including that of the medical social worker, tuberculosis association worker, health officer, tuberculosis health nurse and layman. Of particular interest was the experience cited by Dr. Harold G. Trimble and his associates[5] with a home care program conducted in Alameda County, Oakland, California. As of March 1, 1951, the county hospital had available 438 tuberculosis beds. There were 74 patients on the county home care program, a percentage almost identical with that of Seton Hospital. Trimble and his associates conclude that "a home care program is not a temporary stop-gap to relieve a current emergency but can well be integrated as an essential part

of the care of any tuberculosis patient, whether he depends upon the community for his medical care or can pay his own way."

In England a number of plans are in use in an effort to reduce sanatorium waiting lists. Some of these involve the induction of pneumothorax or pneumoperitoneum in the patient's home, the hospital bed being used later for severing adhesions, phrenic nerve interruption, bronchoscopy or other major procedures. Other plans involve keeping the patient for a few days in the hospital for the induction of pneumothorax or pneumoperitoneum and then sending the patient home.[6,7] The Bedfordshire scheme depends on the allocation of sanatorium beds to clinic physicians and the choice of a selected group of patients for these beds. A close liaison is maintained between clinic physicians and medical superintendents to induce a rapid turnover of suitable cases. Home care is reserved for patients unsuitable for collapse therapy and for those awaiting major surgery.[8] The nearest approach on the Continent to the programs evolved in Alameda County and Seton Hospitals are those of the United Cambridge Hospitals[9] and the Peppard Experiment.[10] Heaf stresses the fact that domiciliary treatment can be beneficial but to carry it out successfully requires money, good equipment, staff and all those facilities that enable the patient to take the necessary rest at home.[11]

On the whole, schemes involving home treatment in the pre-hospital period are inadequate and in some respects injurious to the welfare of the tuberculosis patient. The induction of pneumothorax or pneumoperitoneum at home accomplishes little at best; more often it exposes the patient to complications and prolonged confinement. Better if such an individual remains resting at home until a hospital bed becomes available. Modern treatment of pulmonary tuberculosis depends on close team work between physicians and surgeons; successful treatment, on *proper timing* of the various therapeutic measures now available. The preferred plan is to hospitalize the patient as soon as possible for a sufficiently long time to insure stabilization of the disease and then, if home conditions permit, to utilize home care under strict medical and nursing control until the disease is brought to arrest.

In a recent address, Miss Katharine F. Lenroot, former chief of the United States Children's Bureau, is quoted in the New York Times (June 13, 1952) as stating that one of the great challenges confronting hospital administration was "the need for developing surroundings and practices in the hospitals that will tie in with the experience at home and strengthen, rather than lessen, family ties." She cited such experiments as the use of "natural childbirth," the "rooming in" method and the participation of the father in the experience of maternity. In other words, hospital experience should be made more homelike and more fully a part of the life experience of the entire household. By the same token and as a natural corollary, experiences and practices acquired in the hospital should be continued at home and in the case of an infectious disease such as tuberculosis, this is most desirable. A home care program therefore serves a useful purpose in this respect.

SUMMARY

1) A home care program was inaugurated at Seton Hospital in 1950 to meet an urgent need for beds for the tuberculous. It was soon realized, however, that the program has a definite place in its own right in the management of tuberculosis patients equal in importance to that of occupational therapy, rehabilitation and social service departments of the hospital.

2) The home care program for the tuberculous rests on the assumption that an intelligent, cooperative patient partially restored to health can be treated for part of his long-term illness at home to his ultimate benefit. The home care program has been found most useful for patients undergoing major thoracic surgery. After such operations most patients are able to spend part of the time at home convalescing, a period otherwise spent in the institution. To a lesser extent the program is suited for patients receiving pneumothorax and pneumoperitoneum with effective collapse of the lung as well as patients with spontaneously regressive tuberculosis in whom there is a reasonable expectation that in time the disease will become arrested.

3) Patients with progressive disease, those with persistent tubercle bacilli in the sputum, those in immediate need of surgery or those in need of involved diagnostic and therapeutic procedures are not suited for the home care program. Neither are custodial patients or those who ordinarily qualify for the out patient department.

4) Two basic criteria are utilized in the conduct of the home care program. First, the condition of the patient must have improved sufficiently to permit continued treatment at home; secondly, home conditions must be adequate.

5) Our experience in a city hospital caring for indigent patients has shown that a home care program for the tuberculous is feasible and desirable from the viewpoint of the patients' welfare as well as from the viewpoint of community needs.

RESUMEN

1) En 1950 se inició un plan de tratamiento a domicilio dependiente del Hospital Seton a fin de hacer frente a la urgente necesidad de camas para los tuberculosos. Se descubrió pronto que este plan ocuparía un lugar por su propio derecho en el tratamiento de la tuberculosis con una importancia igual a la de la terapia ocupacional, la rehabilitación y el servicio social del Hospital.

2) El plan de tratamiento a domicilio reposa sobre la base de que un enfermo parcialmente recuperado, con deseos de cooperar inteligentemente, puede ser atendido de su enfermedad de larga duración en su domicilio con resultado final bueno. El tratamiento domiciliario se ha encontrado de lo mas util en los enfermos que se sujetan a cirugía mayor. Después de tales operaciones la mayoría de los enfermos pueden pasar parte del tiempo en sus domicilios convalesciendo durante un periodo que de otro modo pasa-

rían en la institución. En grado menor el plan es adecuado para los enfermos tratados con neumotorax y neumoperitoneo, con colapso efectivo pulmonar así como para los enfermos con tuberculosis espontáneamente regresiva en los que es de esperarse razonablemente que la enfermedad se detenga.

3) Los enfermos con enfermedad progresiva, los que tienen bacilos de Koch persistentes en los esputos, los que estan necesitando de inmediato la cirugía o aquellos que requieren procedimiento de diagnóstico y de terapéutica no corresponden a este plan. Tampoco son para este plan los enfermos que requieren custodia o los que de ordinario son calificados como externos.

4) Dos criterios básicos son usados en la conducción del cuidado domiciliario. Primero: La enferemdad del sujeto debe haber mejorado suficientemente para permitir un tratamiento continuado en su casa. Segundo: Las condiciones en su domicilio deben ser adecuadas.

5) Nuestra experiencia en un hospital de la Ciudad que tiene a su cargo enfermos indigentes ha demostrado que el plan de atención domiciliaria de los tuberculosos es factible y deseable desde el punto de vista de los enfermos así como desde el punto de vista de las necesidades de la comunidad.

RESUME

1) Un programme de traitement à domicile à été inauguré à l'Hôpital de Seton en 1950 pour pallier au besoin de lits pour les tuberculeux. On à réalisé très rapidement toutefois, que ce programme à sa place dans les soins à donner aux tuberculeux. Elle peut être aussi importante que l'activité de post-cure, la réadaptation et les services sociaux des hôpitaux.

2) Le traitement à domicile repose sur la compréhension et la collaboration du malade en voie de stabilisation qu'on peut traiter ainsi chez lui pendant un certain temps au cours de sa maladie, pour son plus grand profit. On à trouvé ce traitement utile surtout pour les malades qui ont été justiciables de la grande chirurgie thoracique. Après de telles opérations, la plupart des malades sont capables de passer une partie de leur convalescence chez eux, période qu'habituellement ils poursuivaient en milieu sanatorial. Sur une moindre échelle, ce programme peut être adpaté au malade traité par pneumothorax ou pneumopéritoine avec un bon collapsus du poumon, aussi bien qu'au malade atteint de tuberculose régressant spontanément, et pour laquelle on peut raisonnablement espérer qu'avec le temps l'affection cessera d'évoluer.

3) Le traitement à domicile n'est pas applicable aux malades atteints de tuberculose active, à ceux dont l'expectoration renferme des bacilles de Koch, à ceux dans l'attente immédiate d'une intervention, à ceux qui ont besoin de précisions diagnostiques et de soins médicaux. Il ne convient pas davantage aux malades en observation, et à ceux qui appartiennent aux consultations extérieures.

4) Pour permettre le traitement à domicile, on considère comme indispensables deux critères de base: d'abord l'état de santé du malade doit avoir évolué de façon assez satisfaisante pour permettre la continuation

de son traitement à domicile, ensuite les conditions familiales doivent être convenables.

5) Notre expérience dans un hôpital a prouvé que le traitement à domicile de tuberculeux résout deux problèmes, celui du bien-être des malades, et celui des desoins de la collectivité.

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Roentgenographic Aspects of Complete and Incomplete Pulmonary Infarction*

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With the advent of effective medical and surgical therapy for pulmonary and systemic thromboembolic disease, it has become essential for the radiologist to diagnose this disease in the lung as rapidly and accurately as possible. The appearance of pulmonary emboli and thrombi on the x-ray film is varied, and in this paper an attempt will be made to review the roentgenographic appearance in 25 cases (see Table I) in which there were positive findings, and to correlate these with other cases reported in the literature.

Incidence

The high incidence of pulmonary embolism is attested by numerous studies. Barnes[1] estimated that 33,748 people die from this cause annually in the United States; if this is applied to the general population, it may be assumed that 3,068,000 people now living in this country will eventually die of pulmonary embolism—and for every fatal attack, there occur two or three instances of non-fatal episodes. Belt[3] found pulmonary emboli in about 10 per cent of 567 routine autopsies, causing death in about 6.5 per cent of them. In 3,500 post-mortem examinations, Hampton and Castleman[12] found pulmonary emboli in 9 per cent; they caused death in 3.5 per cent. These included post-operative, cardiac and medical cases, being respectively 40, 30 and 30 per cent. In another study of 6,548 autopsies, Krause and Chester[22] found hemorrhagic infarcts in 5.2 per cent. Pulmonary emboli caused 6 per cent of all post-operative deaths at the Mayo Clinic between 1917 and 1927,[14] and 5.8 per cent between 1928 and 1933.[1] An actual increase in the incidence of cases of thromboembolism has been reported from Tulane University and Massachusetts General Hospital;[28] these statistics make apparent the necessity for early diagnosis of these disorders.

It has been stated that the diagnosis of an infarct by x-ray examination is probably subject to more error than any other lesion of the lungs; the error is almost always a negative one, i.e., failure to consider an infarct as the cause of the abnormal shadow.[21,24] Carlotti, Hardy, Linton and White[5] said that pulmonary emboli were probably diagnosed in less than half of the medical patients in whom they were found at autopsy. They reported on 108 cases studied between 1936 and 1940 at the Massachusetts General Hospital in which the infarct was observed on the x-ray film in only 36 cases (33 per cent); between 1941 and 1945 an infarct was reported

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on the interpretation in 73 out of 122 cases (60 per cent). Incidentally, the diagnosis of a "consolidation" dropped from 48.2 to 18.9 per cent in these two series. Krause and Chester[22] in a review of 344 aseptic hemorrhagic infarcts, reported that the correct diagnosis had been made in only 22 per cent. In a review of 74 autopsied cases of pulmonary emboli, Dehlinger and Riemenschneider[9] found that only 28 had chest x-ray films; in 18 of these the emboli were not recognized because of the presence of other pulmonary or pleural disease. In the 10 remaining cases, pulmonary emboli with or without infarcts were the only pathological findings, and in five of these there were no abnormal radiographic densities; in the other five, the greatest misinterpretation of shadows cast by infarcts, the only pathologic process found at autopsy, was with pneumonitis or broncho-pneumonia. Vander Veer and his co-workers[33] stated that 42 out of 89 cases of pulmonary emboli had x-ray film signs of pulmonary infarction, consolidation, atelectasis or pleural effusion, and that nine more (in review) had localized areas of emphysema.

Thus, the accuracy of the roentgenographic diagnosis of pulmonary infarction and embolism is low as compared to the recognition of other pulmonary diseases. In our experience, one of the major causes for this was the patient's poor condition, so that bedside films were the only kind available for study. It is conceivable that with technical improvements, a higher degree of diagnostic accuracy will result. Robbins[31] recommended that the following techniques be utilized when possible: fluoroscopy, spot films, a high kilovoltage (85-95) with a short exposure, PA projections, lateral and oblique projections if spot films were not available, and finally, six-foot films. With improvements in techniques, it should be possible to obtain six-foot films for patients in their beds, in the x-ray rooms.

Rigler[29] stated that careful attention must be given to the history, in order to differentiate infarcts from pneumonia, and this may be of more value than any other technical aid.

Classification

In this paper the classification of Hampton and Castleman[12] will be used, adding to it a discussion of the appearance of pulmonary emboli without infarction. In their classic paper, they subdivided pulmonary infarcts into two types: the complete and the incomplete. In the former there is a sequence in the involved lung area consisting of the following: filling of the alveoli with blood, while larger units, such as the alveolar sacs and atria remain filled with air, up to 24 hours. (Thus, there may be difficulty for 12 to 24 hours in visualizing the process on the films.) At the end of 24 hours necrosis of the alveolar walls and degeneration of the red cells commences. Organization begins in the second week and may last for months until a fibrous scar remains; a very large infarct may remain hemorrhagic indefinitely. The incomplete infarct begins similarly, with edema, fluid and red and white cells in the alveoli; this does not progress to alveolar wall destruction and heals by resolution in two to four days.

TABLE I

Case	Age	Sex	Etiology	Location	Shape	Size (cm.)	Secondary Signs
1.	42	F	Surgical	LLL RLL	Pyramidal Rhomboid	3 x 6 4 x 8	Interlobar fluid
2.	35	M	Cardiac	LLL	Rectangular	2 x 4	None
3.	62	F	Traumatic	RLL	Rectangular	2 x 3	None
4.	65	M	Cardiac	RLL LLL	Rectangular Rectangular	4 x 5 4 x 5	None
5.	50	M	Surgical	RLL	Band-like	1 x 3.5	Enlarged right hilum
6.	21	F	Post-partum sepsis	RLL	Pyramidal	6 x 6	None
7.	67	F	Medical	LUL Right base	Round Round	4 x 4 3 x 3	None
8.	45	F	Pelvic thrombo-phlebitis	RLL	Triangular	2 x 2.5	Pleural fluid
9.	49	M	Medical	RUL LUL	Round Oval	6 x 6 5 x 6	None
10.	9	F	Surgical	RLL	Rectangular	4 x 6	None
11.	35	M	Medical	RUL RLL	Round Rectangular	3 x 3 6 x 6	Encapsulated fluid
12.	68	M	Medical	LLL LUL	Rectangular Rectangular	1 x 2.5 1 x 2.5	Pleural fluid, elevated diaphragm

TABLE I (Continued)

Case	Age	Sex	Etiology	Location	Shape	Size (cm.)	Secondary Signs
13.	25	F	Post-partum sepsis	LLL	Rectangular	4 x 5	None
14.	70±	F	Cardiac	RUL Right base	Rectangular Rectangular	4 x 5 3 x 3.5	Pleural fluid
15.	55	M	Surgical	LLL	Oval	2 x 4	Elevated diaphragm
16.	50	F	Cardiac	LLL RLL	Rectangular Rectangular	6 x 5.5 4 x 5	Slight diaphragmatic elevation
17.	61	M	Medical	RLL	Rectangular	5 x 9	None
18.	60	M	Medical	Both bases	Linear scars		None
19.	?	F	Cardiac	RLL	Rectangular	6 x 9	Pleural fluid, slight diaphragmatic elevation
20.	60	M	Cardiac	RUL	Round	7 x 7	None
21.	80	M	Cardiac	RUL	Oval	4 x 4	None
22.	79	M	Cardiac	RUL RLL	Band-like Band-like	3 x 0.5 4 x 1	Elevated diaphragm
23.	37	M	Medical	LLL	Triangular	0.5 x 1	None
24.	28	M	Medical	RUL Right base	Triangular Rectangular	3 x 6 4 x 8	Slight diaphragmatic elevation
25.	55	M	Cardiac	LLL	Band-like	0.5 x 2	Slight diaphragmatic elevation

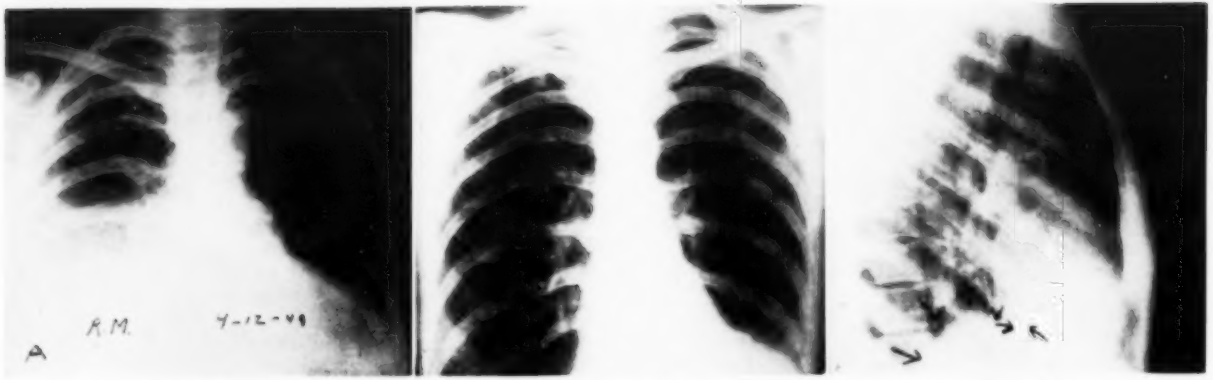

FIGURE 1A FIGURE 1B FIGURE 1C

Figure 1, Case 1: A 42-year old female with multiple septic infarcts following pelvic and abdominal surgery, with good response to protracted antibiotic and anticoagulant therapy—*Figure 1A:* Infarct at right base, impossible to distinguish from pneumonia. History essential for diagnosis.—*Figure 1B:* Second large infarct at left base, three months later.—*Figure 1C:* Lateral view, on same day, demonstrates the rounded cardiac margin, the pyramidal shape, and the adjacent small interlobar effusion; note, also, that the long diameter of the infarct is parallel to the largest pleural surface. The density is homogeneous and the margins are sharp. This resolved slowly, leaving a linear scar and small pleural adhesions.

Complete Infarcts

There are both primary and secondary manifestations of complete infarcts. The primary signs are those produced by the infarct itself and the secondary signs by the effects of the infarct (see Table I). The primary signs are as follows:

1) An abnormal density is present which is variable in shape, depending entirely on its location to determine its configuration. Thus, it may be pyramidal or triangular, round, oval or irregular.[12,17,20,22] Odd and round shadows may be caused by superimposition of multiple infarcts and should be "dissected" by multiple films, including spot films. The borders are sharp if seen in the degree of obliquity in which its greatest thickness is penetrated. The infarct is always in contact with one or more pleural surfaces; the cardiac margin is rounded or "hump-shaped."[12] The long diameter is always parallel to the largest pleural surface involved.[13]

In the cases recorded in this paper, these criteria have been found; also noted has been the homogeneous character of the density in all cases. Helpful in reaching a diagnosis of infarction has been the occasional odd shape of the lesion—oval, band-like, rectangular or amorphous. Figures 1A and 1B show the usual appearance, that of large basal densities which resemble pneumonias, but can be appreciated as infarcts when additional views are obtained—Figure 1C. Figures 2, 3, 4, 5, 6B, 7B and 8B are other infarcts, some with markedly irregular shapes.

2) The density may be small or large, varying from 0.3 to 10 cm., and averaging 3 x 2 x 1 cm.; one or many may be present.[12] Our series showed larger lesions; the average size was 3.5 x 5 cm.; multiple lesions were common.

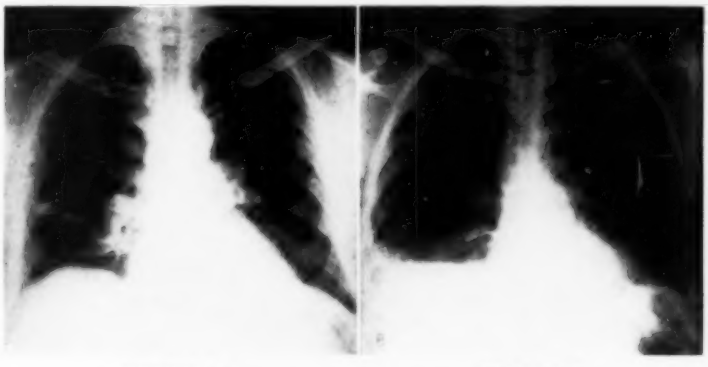

FIGURE 2

Figure 2, Case 5: A 50-year old male who developed a pulmonary infarct five days after a herniorrhaphy. Anticoagulant therapy successful. Film shows an odd almost rectangular density in right lung; it is sharply defined and has no secondary signs of fluid or diaphragmatic elevation. Note abdominal distention.

FIGURE 3

Figure 3, Case 8: A 45-year old female; pulmonary infarct appeared seven days after spontaneous rupture of cul-de-sac abscess; septic pelvic thrombophlebitis; good response to dicoumerol and antibiotics. Film shows well-demarcated, homogeneous density above right costo-phrenic angle; this disappeared without sequelae in one month.

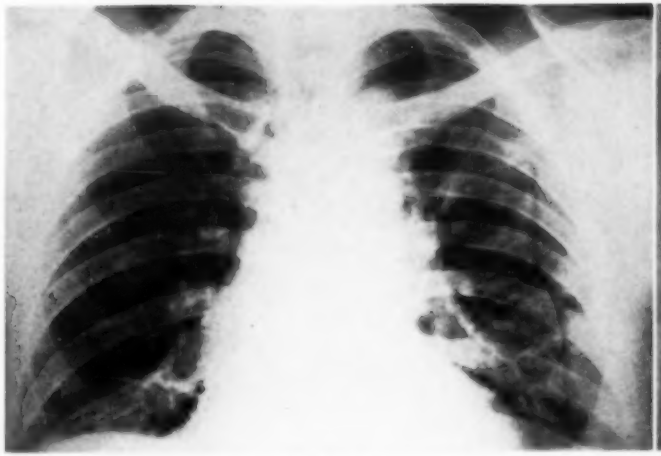

FIGURE 4

FIGURE 5

Figure 4, Case 12: A 68-year old male with multiple small pulmonary emboli secondary to thrombo-phlebitis of left leg; controlled by dicoumerol. Rectangular, homogeneous, small infarcts seen on the film, in left lung, together with characteristic long linear scars of old infarcts at right base.—*Figure 5, Case 20:* A 60-year old male with hemoptysis and pleural pain in December 1950 and March 1951; arteriosclerotic heart disease and auricular fibrillation. Round, sharply defined homogeneous mass seen on film; this was in anterior segment of right upper lobe. Pre-operative diagnosis was peripheral carcinoma of lung. Lesion excised and found to be characteristic pulmonary infarct.

3) The location is variable. Of 344 hemorrhagic infarcts, Krause and Chester[22] reported involvement in the right lower lobe as 27 per cent (solitary infarcts) and in the left lower lobe as 15 per cent; in the right lower lobe combined with infarcts in other lobes there were 69 per cent, and in the left lower lobe combined with other lobes there were 53 per cent. Hampton and Castleman[12] reported 74 per cent in the lower lobes, 43 per cent on the right and 31 per cent on the left. Kirklin and Faust[20] reported 18 infarcts at the right base, three at the base of the right upper lobe, three in the left lung, and four in both lungs. Thus, there is some predilection for the right lower lobe, and this has been our observation too, the right lung being the site of an infarct two times as often as the left, with the right lower and middle lobes being involved in 44 per cent of cases.

4) Hemorrhagic infarcts heal by organization, from the periphery inward.[17] Usually, a scar is left consisting of masses of dense, tangled elastic fibrils[25] which may be visible on the film as an irregular linear band.[20] Fleischner, Hampton and Castleman[10] have described this scar as a dense single line which runs in any direction, reaches a pleural surface and ends either as a rounded nodular shadow flat against the pleural surface or directly in a thickened or retracted pleura; multiple lines due to multiple infarcts may be present. These shadows are to be differentiated from areas of plate-like atelectasis and interlobar pleuritis[10,12,26] (Figure 4). However, an infarct may clear completely.

5) Various complications have been reported from pulmonary infarcts. These have included pneumonia, abscess and bronchopleural fistula with empyema.[17,20,21,22] We have observed one instance of encapsulated fluid which cleared slowly on medical management alone. Pleural effusion as

FIGURE 6A FIGURE 6B

Figure 6, Case 23: A 32-year old male with periodic bouts of pulmonary emboli for several years; autopsy showed thrombophlebitis of femoral veins and multiple pulmonary infarcts.—*Figure 6A:* Linear shadows at left base believed to represent incomplete infarcts. Note short length and oblique orientation.—*Figure 6B:* 24-hours later, several small infarcts are seen in same location; these are broad densities, oriented in similar manner; complete clearing in a week. A large infarct developed a month later; just before death (eight months later) residual scars and pleural adhesions were present.

FIGURE 7A FIGURE 7B FIGURE 7C

Figure 7, Case 24: A 28-year old male with multiple pulmonary emboli and massive cardiac enlargement. Poor response to anticoagulant therapy. Complete recovery after ligation of inferior vena cava (followed for $1\frac{1}{2}$ years). — *Figure 7A and 7B:* Linear shadows believed to represent incomplete infarcts in lower two-thirds of left lung, varying in position over a six-day interval. These corresponded with clinical evidence of pulmonary emboli. Complete clearing in 10 days. — *Figure 7C:* Complete infarcts three weeks later, in right lung. Complete resolution in two weeks; no residual scars or pleural changes.

a complication will be discussed later. In general, the presence of complications, in these days of potent antibiotics, makes the diagnosis more difficult and might cause one to question the original diagnosis.

Many secondary signs of pulmonary emboli have been described:

1) Clouding in the region of the costophrenic angle on the side of the infarct has been described as a sign of an infarct.[17] Wharton and Pierson[33] reported it is the first sign of an infarct, appearing 24 hours after the onset of symptoms, while the remainder of the lung was still clear. The explanation for this phenomenon is not clear, and one assumes that if this does happen, it represents an impairment of the pleural integrity. In this series, this sign has not been observed.

2) Accentuation of the hilar vessels on the side of the lesion has been reported as a contributory sign of an infarct.[17] This is assumed to be due to dilatation of the pulmonary vessels on the affected side,[36] and if present, is probably due to passive hyperemia.[22] In this series, dilatation has been noted in the hilum, but has been attributed to congestive changes, rather than to the embolus or infarct. Apparently Rigler also attributes this to congestive changes, judging from the description of the lesions in his monograph, "The Chest."[29]

3) The presence of a prominent pulmonary conus is not a reliable secondary sign of an infarct. This was demonstrated indirectly by Horn, Dack and Friedburg[16] who, in 42 patients dying after pulmonary emboli, found no definitive cardiac change; the degree of dilatation of the right side of the heart was uncertain; marked dilatation occurred in only four cases, and the evaluation of slight or moderate dilatation was very uncertain and difficult in the post-mortem state. This finding was not observed in these 25 cases.

4) Elevation of the diaphragm on the affected side is not a reliable sign of infarction; it has been observed in seven of our cases, but not in those with scars in the parenchyma, in which a loss of pulmonary volume could be assumed.

5) Pleural effusion may or may not be secondary to an infarct. This is difficult to prove. Hampton and Castleman[12] found effusions in only 40 per cent of their cases, but in only 13 per cent did it seem likely that the infarct produced the fluid; rather could it be attributed to congestive failure. In the absence of congestive failure it might be assumed that the fluid is on the basis of the infarct.[21] A large effusion may conceal the infarct entirely.[13] Figure 1C demonstrates some of the pleural changes.

Moberg[27] reported that the pleural effusion was of greater roentgenographic dominance than the parenchymal density in about half of 46 cases of pulmonary embolism. This is contrary to our own experience, in which five cases showed small amounts of fluid; only in a sixth case was the amount of fluid large; even in the latter, the density of the infarct was not hidden by the fluid.

In general then, the secondary signs described heretofore seem to be misleading, with the exception of the small pleural effusion in the presence

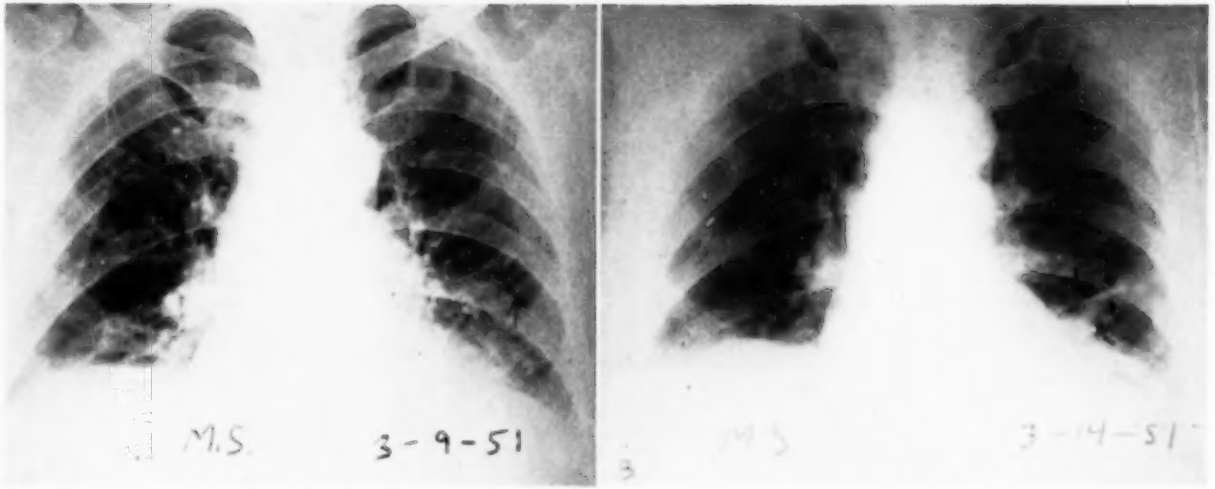

FIGURE 8A FIGURE 8B

Figure 8, Case 25: A 55-year old man with pleural pain and hemoptysis; arteriosclerotic heart disease.—*Figure 8A:* Linear shadows in left lung probably representing incomplete infarcts.—*Figure 8B:* Seven days later, an irregular density is present in same location, representing a complete infarct. Patient lost to follow-up.

of contiguous parenchymal disease, in a non-cardiac patient; in this situation this may be valuable indirect evidence of an infarct.

Incomplete Infarcts

The incomplete infarct was first described by Wharton and Pierson,[35] and later by Hampton and Castleman,[12] as an abortive or incipient infarct, one that ended by resolution instead of organization, and therefore, disappeared in 24 to 48 hours. Pathologically, there is edema; red and white blood cells appear in the alveoli but no alveolar wall destruction occurs. Several observers[15,18,35] came to the conclusion that simple bland embolism of the pulmonary artery produced circulatory changes in the lung area but not a true infarction, unless there was passive congestion. It has been postulated[8,12] that this condition was caused by multiple small emboli arising from thrombi in an operative field. This can occur in the normal lungs of animals; thus, a transitory x-ray shadow may be produced. It has been thought that this situation may be similar to that found in the early stage of an infarct and that if the conditions are proper (circulation is disturbed), the incomplete infarct will go on to completion; if not, it will disappear by resolution. The x-ray film appearance of the incomplete infarct has not been hitherto described. In three cases described here (Figures 6, 7 and 8) faint, sharp, short (2 to 4 cm.) lines were seen in chest films, coincident with the clinical occurrence of pulmonary emboli; these were situated transversely or obliquely and were preceded by negative roentgenograms; they changed character in two to seven days. In each of two cases, the source of emboli was the inferior vena cava; one recovered after ligation of the inferior vena cava; the second had post-mortem proof of a thrombus in that vessel.

The sharp lines observed in these three cases had to be differentiated from linear atelectasis, pulmonary scars, and interlobar pleuritis. This was done as follows:

1) Linear or plate-like atelectases appear on films as multiple, long, linear shadows which are constantly horizontal, occurring at the bases of the lungs and are associated with elevation of the diaphragm and intra-abdominal lesions; they are usually perpendicular to the longitudinal fissures.[10,26] The shadows believed to represent incomplete infarcts occurred in the middle third of the lungs, as well as the bases, were short, often oblique in the frontal view, often single and not associated with abdominal lesions; slight diaphragmatic elevation was noted in only one instance.

2) Pulmonary scars could be ruled out since previous films were negative and the linear shadows changed character or disappeared quickly.

3) Interlobar pleuritis could not be demonstrated in these three cases; the position of the shadows described was different from that of the lung fissures.

It would seem logical to attribute these abnormal, transient linear shadows to the embolic disease of the lung; in one case, the shadow dis-

appeared after several days; and in the other two cases complete infarcts appeared at the same site, within 24 to 48 hours.

Obviously, the experience in interpreting these linear shadows is limited and adequate explanation of the x-ray appearance is lacking; further studies and observations are necessary to verify the suggestion present, and preferably anatomical proof should be obtained, although this may be very difficult.

The concept of the incomplete infarct probably overlaps that of the pulmonary embolus without infarction. Westermark[34] first described the shadow cast on the film by the latter condition as a sharp, local area of increased radiability (ischemia or anemia) on the peripheral side of the lung embolus. On the central side he noted abrupt cessation of the vascular markings; the ischemic area was wedge-shaped with its apex to the hilum and the base to the lung periphery. His explanation for this observation was that when a pulmonary embolus occurred in a patient without stasis of the pulmonary circulation there would be no infarct; in this situation there would be ischemia of the involved part of the lung producing an anemic, pale and aerated area.

Shapiro and Rigler[32] described this phenomenon in detail in three cases; they pointed out that this appearance can also be found contiguous to an area of hemorrhagic infarction. Vander Veer et al., in a review of 89 cases of pulmonary infarction found nine instances of localized pulmonary "emphysema," but details of these cases were not presented.[33]

There is some evidence, however, that suggests a close parallel between the pathologic findings in the incomplete infarct and in the embolus without an infarct. There is a general lack of proof of the existence of a pale infarct of the lung.[2,4,18] Holman and Mathes[15] are quoted as having produced pale infarcts with sterile emboli in dogs, but a review of their experimental data shows that they produced a slight edema and hemorrhagic infiltration in 30 of 32 animals; this is probably the same as an incomplete infarct. Physiologic and anatomic factors also support this hypothesis: the adequacy of the bronchial artery in nourishing the abnormal pulmonary zone[15] and the richness of the anastomoses of the branches of the pulmonary artery in areas of lung less than lobar in size.[6,7,19]

In a review of 173 cases of pulmonary embolism in cardiac patients Lenegre and Neel[23] found embolism without infarction in 92 instances, and with infarction in 53; Westermark's sign was not observed. Moberg[27] did not find it in 46 cases, nor has it been found in this series of cases. The paucity of roentgen evidence in situations in which there is good clinical evidence of pulmonary emboli may well lead the radiologist, when confronted by a negative roentgenogram,[30] or one with the above described lines, or with a zone of ischemia, to a diagnosis of pulmonary embolism without infarction or with incomplete infarction.

Acknowledgement: The author is indebted to Dr. L. G. Rigler for invaluable constructive criticism and advice.

SUMMARY

1) There is a very high incidence of pulmonary thromboembolic disease. This appears to be on the increase.

2) Examples of complete infarcts are given, emphasizing their radiographic variability. The odd shape of a homogenous density is sometimes helpful in diagnosis. Multiple x-ray films are important. Secondary signs are usually unreliable.

3) The importance of recognizing the incomplete infarct is stressed. Three examples are described.

4) Embolism without infarction (or, probably with incomplete infarction) occurs very frequently; an area of pulmonary ischemia may be a roentgen sign of this situation, as described by Westermark and others. Also, clinical evidence of a pulmonary embolus associated with negative roentgen evidence may warrant this diagnosis, too.

RESUMEN

1) Existe una elevada frecuencia de enfermedad tromboembólica del pulmón. Esto parece que está aumentando.

2) Se dan ejemplos de infartos completos, haciendo notar su variabilidad radiográfica. La extraña forma de una sombra densa homogénea es util a veces para el diagnóstico. Son importantes las radiografías múltiples. Los signos secundarios habitualmente no son dignos de crédito.

3) La importancia de reconocer el infarto incompleto se recalca. Se describen tres ejemplos.

4) La embolia sin infarto (o probablemente con infarto incompleto) ocurre muy frecuentemente; un area de isquemia pulmonar puede ser un signo de esta condición tal como ha sido descrita por Westermark y otros. También la evidencia clínica de un émbolo pulmonar sin evidencia a los rayos X puede justificar este diagnóstico.

RESUME

1) Il y à actuellement une très grande quantité d'embolies pulmonaires. Cette affection semble être en augmentation.

2) L'auteur rapporte des exemples d'infarctus complets, en insistant sur la variabilité de l'aspect radiologique. L'aspect atypique de l'ombre homogène est parfois précieux pour le diagnostic. Il est important de pratiquer des radiographies multiples. Les signes secondaires restent habituellement sans valeur absolue.

3) L'auteur insiste sur l'importance qu'il y à reconnaitre l'infarctus incomplet. Il en donne trois exemples.

4) L'embolie sans infarctus, ou probablement avec infarctus incomplet est une éventualité très fréquente. Cet état peut se caractériser radiologiquement par l'existence d'une zone pulmonaire ischiémique ainsi que l'ont décrite Westermark et d'autres auteurs. Ainsi, il est possible d'affirmer le diagnostic d'embolie pulmonaire sur des signes cliniques évidents, en l'absence de toute image radiologique.

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Cervical Sympathetic Stimulation Caused by Carcinoma of the Lung*

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In 1838 contraction of the pupil of the left eye and paralysis of the levator palpebral muscle were described by Hare.[1] In 1869 Horner[2] reported the case of a 40 year old woman who showed drooping of the eyelid of the right eye, the pupil of the right eye more narrow than the left, the bulb insignificantly shrunken backward, and redness and heat on the right half of the face while the left half of the face remained pale and cool. These symptoms have become known as Horner's syndrome and generally indicate cervical sympathetic paralysis. Raeder[3] in 1924 wrote that Horner's syndrome is most complete from injury to the cervical sympathetic trunk but can arise from lesions involving the spinal cord, the brain and peripheral sympathetic nerves, especially involvement of the oculopupillary fibers or involvement of the internal carotid sympathetic fibers by suppurative otitis media, or herpes zoster. Langworthy[4] believed the physiology of pupillary activity to be obscure and that Horner's syndrome could be caused by lesions other than cervical sympathetic paralysis. He felt that injury to the cervical spinal cord or the dorsolateral portion of the medulla, and thrombosis of the posterior inferior cerebellar artery or of the artery of the lateral sulcus would produce Horner's syndrome. Budge and Waller[5-8] first showed that cervical sympathetic nerves had their origin in the dorsal portion of the spinal cord, especially dorsal segments one and two. Lesions of one and two dorsal sympathetic ganglia will characteristically produce Horner's syndrome.

Raeder described a patient who showed contraction of the pupil and ptosis of the upper eyelid without sweating. These symptoms were caused by a tumor at the side of the trigeminal nerve and involved only the sympathetic fibers destined for the eye. Raeder's syndrome is therefore less complicated than Horner's syndrome. In 1924 Pancost[9,10] described a syndrome greater than Horner's. It is a Horner's syndrome plus involvement of the eighth cervical and first dorsal (ulnar nerve) nerve roots. In 1932 Pancost had observed the same findings in seven patients. These consisted of Horner's syndrome and in addition pain down the ulnar side of the arm with weakness of the grip, wasting of the small muscles of the hand, and destruction of bone of the thoracic cage. This particular group of findings has become well known as the Pancost syndrome and is caused by a superior pulmonary sulcus tumor; however, it is not necessarily caused by a neoplasm of the same pathologic characteristics as described by Pancost.

Pathologic lesions producing paralysis of the cervical sympathetic fibers are not uncommon. When the author first examined a patient who revealed

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unilateral cervical sympathetic stimulation the condition was temporarily mistaken for paralysis of the cervical sympathetic nerves of the opposite side. A chest roentgenogram revealed a posterior apical mass in the lung on the side of the increased perspiration, dilatation of the pupil and widening of the palpebral fissure, which made it evident the observed phenomona resulted from stimulation of the cervical sympathetic nerves.

Bernard[11-15] experimentally determined the physiology of the cervical sympathetic nerves and described the effects of paralysis and stimulation which are now well known. The history of the experimental studies showing the physiologic effects of the cervical sympathetic nerves has been well reviewed by Fulton.[16] Horner's syndrome indicates paralysis whereas stimulation would result in findings exactly opposite those of Horner's syndrome; that is, dilatation of the pupil, widening of the palpebral fissure and increased perspiration on the same side of the face, slight reddening of the conjunctiva, and a slight increase in lacrimation may occur. Parsons[17] reported that the same findings occur from stimulation over a considerable area of the frontal and occipital regions of the brain.

Case Reports

Case 1: H.V. was a white male, age 38. In August, 1946 he noticed paresthesia on the medial side of the left arm and a little later there was pain in the left shoulder. In October, 1946 he began to cough for the first time and in a few days expectorated blood. Early in November, about two or three weeks before being examined, he noticed sweating over the left half of the upper part of the body, particularly the head, and at this time he seemed to cry easily. Physical examination revealed a thin patient with normal findings except for a dilated pupil of the left eye, widening of the left palpebral fissure with questionable exophthalmos of the left eye, sweating of the left side of the head, and slight impairment of the percussion note over the apex of the left lung posteriorly. Laboratory studies were within normal limits except for the roentgenogram that revealed a small shadow over the extreme apex of the left lung, a finding often described as thickening of the apical pleura. A diagnosis of carcinoma of the lung with stimulation of the cervical sympathetic fibers was made. On November 19, 1946 an excision of the left lung was accomplished. The posterior apical mass was seven centimeters across its greatest diameter. It was intimately attached to the chest wall near the transverse processes of the first, second and third dorsal vertebrae but it did not invade the vertebrae or their processes. The sympathetic trunk was not invaded but was intimately adherent to the mass. The tissue about the sympathetic trunk was thickened. About 8 to 10 centimeters of the sympathetic trunk were removed from above the inferior cervical ganglia downward. Since the neoplasm was thought to invade the chest wall, the chest wall including the posterior third of the five upper ribs with their corresponding transverse processes was removed en masse without separation from the lung. The patient made an uneventful recovery. After operation he exhibited a typical Horner's syndrome that he maintained until death from metastases on November 9, 1948. The pathologic diagnosis was "Bronchogenic carcinoma of the squamous cell type with invasion of the chest wall at the apex of the thorax." At that time the unusual nature of these findings was not fully appreciated and no microscopic pathologic examination was made of the sympathetic trunk.

Case 2: R.S., a white male, age 52, reported that he had been treated for asthma on several occasions. In August, 1949 he expectorated blood for the first time and this continued. He lost weight and did not feel well. In January, 1950 he developed

fever which caused him to seek medical attention. Physical examination revealed a fairly well nourished man who appeared chronically ill. There was widening of the palpebral fissure of the right eye, dilatation of the pupil of the right eye, and increased perspiration of the right side of the face and upper extremity. In the neck there was palpable a small, hard lymph node located behind the medial end of the clavicle. There was impairment of the percussion note over the upper third of the chest front and back on the right and impairment of breath sounds over this area. The remainder of the physical examination was essentially normal. Roentgenographic examination revealed infiltration or atelectasis of the upper lobe of the right lung. On February 15, 1950 a biopsy of the palpable cervical node was done. The sympathetic trunk and ganglia were not exposed. The pathologic diagnosis was "Adenocarcinoma, metastatic." Because of the metastatic node operation upon the lung was felt to be contraindicated. He was given roentgen ray therapy with no obvious beneficial effect. He was last examined by the author on May 21, 1950, when it was noted that there was a large mass in the supraclavicular region on the right. The palpebral fissure of the right eye was wider than that of the left. The pupils were the same size and the moisture of the skin was similar on both sides, or perhaps more moist on the left than on the right. On June 14, 1950 he died, but autopsy was not obtained.

The physiologic effect of stimulation of the cervical sympathetic nerve fibers is well known but a rather diligent search of the literature has failed to reveal a description of cervical sympathetic stimulation caused by disease. Unilateral dilatation of the pupil has been reported by Muralt,[18] Jullien,[19] Alterthun,[20] Sawitzkij,[21] Walsh,[22] and Herbert.[23] The dilated pupil on the side of the lesion has been thought to be the result of irritation of the sympathetic nervous system but the site of irritation has not been described. It is said to occur in pulmonary tuberculosis, hydatid cyst of the lung, gangrene of the lung, lung tumor, artificial pneumothorax, bronchiectasis, pericarditis, gastric ulcer, cholecystitis, splenic tumor, chronic appendicitis, and after thyroidectomy.

The two patients described had carcinoma of the apex of the lung. In both there was stimulation of the upper dorsal sympathetic ganglia and in case 1 at least stimulation of the inferior cervical sympathetic ganglia as well. It seems logical to accept the symptom of cervical sympathetic stimulation to indicate superior pulmonary sulcus tumor, particularly carcinoma of the apex of the lung.

In case 1 it was obvious that the inferior cervical sympathetic ganglion, the first and second dorsal ganglia, and the intervening sympathetic trunk were involved by the tissue reaction surrounding the malignant growth. This reaction caused the stimulation of the sympathetic nerves which produced the typical findings. When the involved portion of the sympathetic trunk was removed there was a complete change and the findings were those seen in cervical sympathetic paralysis. In case 2 there was no operation or autopsy to prove the relationship of the sympathetic trunk to the tumor mass, the diagnosis having been proved through biopsy of the metastatic node; however, the roentgenogram of the chest would place the lesion in relation to the sympathetic trunk. If the tumor mass caused stimulation it is reasonable to believe that the natural course of the disease would be invasion of the sympathetic trunk and then paralysis.

The natural course, unfortunately, may have been influenced by roentgen ray therapy. Nevertheless, it is logical to feel that there was indication of a change to paralysis before the death of the patient.

It is interesting to speculate whether Horner's syndrome caused by malignant tumor invasion of the first two dorsal sympathetic ganglia or the cervical sympathetic trunk may be preceded by stimulation. Since paralysis and stimulation are exactly opposite processes it is of interest to consider the possibility of mistaking one for the other. This raises the question as to whether in the past the two conditions have been confused. Pancost described his first observation in 1924. By 1932 he had found only six additional patients presenting his syndrome. However, it is now a well known condition and is seen frequently. Careful observation may reveal that stimulation of the first two dorsal and/or cervical sympathetic nerve fibers is not uncommon.

SUMMARY

There are described two patients with carcinoma of the apex of the lung who exhibited the effects of stimulation of the cervical sympathetic nervous system; namely, widening of the palpebral fissure, dilatation of the pupil, increased sweating on the same side of the face and the upper extremity of the same side. The findings are exactly opposite those found in Horner's syndrome.

RESUMEN

Se han descrito dos enfermos con carcinoma del vértice del pulmón que mostraron los efectos de la estimulación del sistema nervioso simpatico cervical, tales como mayor abertura palpebral, dilatación de la pupila, aumento de la transpiración del mismo lado de la cara y de la extremidad superior del mismo lado. Los hallazgos son exactamente los contrarios a los del síndrome de Horner.

RESUME

Les auteurs décrivent le cas de deux malades atteints de cancer du sommet du poumon qui manifestèrent des effets d'excitation du système nerveux sur la chaine cervicale: élargissement de la fente palpébrale, dilatation de la pupille, accroissement de la sudation du même côté du visage et à l'extrémité supérieure de ce côté. Ces constatations sont exactement à l'opposé de celles du syndrôme de Horner.

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Tuberculosis and Histoplasmosis in Foreign Students Entering Our Colleges

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Introduction

Each year, an increasing number of students from foreign countries enroll in our colleges and universities. Before leaving their native lands, they are required to undergo physical examinations to satisfy immigration authorities that they are free from all known communicable diseases. However, at some time in their lives, some of them have had tuberculosis or some other communicable disease, and even though their former disease is declared inactive and non-communicable at the time of the examination, reactivation or relapse of the disease may occur during the student's residence in this country.

With this in mind, from September 1950 to January 1952, a study was made in the student health service at Ohio State University to determine the relative incidence of tuberculosis and histoplasmosis in all new students entering the university, and the findings in lifetime residents of foreign countries were compared with the findings in the lifetime residents of this country.

Material and Method

Available for this study were 136 foreign-born students representing 47 countries. Their residence in this country before enrollment ranged from one week to two years, except a German-born student who left Germany at the age of 14, lived for six years in the State of Tennessee, and then for six more years in New York State before coming to Ohio State University. This student, and one from Canada were the only positive histoplasmin reactors in the foreign student group (Table I). Also available were 8,807 lifetime residents of this country—85 per cent of whom were native Ohioans.

All students in both groups received an entrance physical examination, a chest x-ray film, and skin tests.

The physical examinations were made by a group of examiners, all specialists in their respective fields.

The initial x-ray film inspections were made in the Ohio State Board of Health Mobile Units using the 70 mm. film. Readings were made by examiners in the Division of Tuberculosis of the Ohio State Board of Health and rechecked by the author. Follow-up studies of all suspects were made by the author using the 4 x 5 stereo and 14 x 17 films.

The skin tests consisted of the intradermal injection of 0.1 cc. of tuberculin (PPD) containing 0.0001 mg., and 0.1 cc. of histoplasmin (Lilly

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Antigen) in 1:1000 dilution. When suspected findings were noted in a person with a negative tuberculin reaction on the initial test, the 0.005 mg. dose of tuberculin was used for follow-up study.

Findings

The findings obtained in this investigation, relative to the incidence of tuberculosis and histoplasmosis in foreign students at the time of their entrance to Ohio State University, revealed some very interesting data when compared with the findings in United States students who entered the university during the same period (Tables I and II).

It is interesting to note that none of the foreign students had active tuberculosis at the time of enrollment, which may be attributed to the health examination required before departure from their native countries.

Discussion

Tuberculosis: We know that tuberculosis may be found in all parts of the world, and that the incidence and the mortality are much higher in the majority of foreign countries than in the United States. A recent study made at the Student Health Service of Ohio State University confirmed these facts. Our study showed that 11.7 per cent of the students from 47 foreign countries had inactive pulmonary tuberculosis at the time of their enrollment, whereas only 0.44 per cent of the United States students were found with the same form of the disease.

During the period of study, 18.7 per cent of the foreign students with inactive tuberculosis developed activity, while none of the students from the United States, having inactive tuberculosis at the time of enrollment, became active.

At the conclusion of the study, 2.3 per cent of all foreign students were under treatment for active tuberculosis, while only 0.03 per cent of the United States students were under treatment for activity. All of the active cases among the United States students were discovered at the time of the entrance examinations and sent to their homes for treatment. The foreign students became active during their stay at the university.

In the foreign student group, 68 per cent were positive tuberculin reactors, whereas only 16.5 per cent of the United States student group reacted to tuberculin.

All of the above facts confirm the higher incidence of tuberculosis in foreign countries.

Histoplasmosis: This was first described by Darling in 1906 as a fatal disease of tropical America. However, fatal cases have also been reported from North America, South America, England, South Africa, the Philippines, and Java.[1] In 1945, the widespread use of the histoplasmin skin test by Christie and Peterson[2-5] to explain the existence of the large number of calcified pulmonary lesions in tuberculin negative reactors, enabled them to suggest the existence of a benign form of histoplasmosis. Positive histoplasmin reactors were found to be highly prevalent in the Midwestern or

TABLE I: Incidence of Tuberculosis and Histoplasmosis in Foreign Students Enrolling at Ohio State University from September 1950 to January 1952.

Country	No. of Students	Tuberculosis		Histoplasmosis		SKIN TESTS			
		Active	Inactive	Fatal Form	Benign	Tuberculin Neg.	Tuberculin Pos.	Histoplasmin Neg.	Histoplasmin Pos.
Australia	2	—	—	—	—	1	1	2	—
Austria	2	—	—	—	—	—	2	2	—
Bolivia	1	—	—	—	—	—	1	1	—
Burma	1	—	—	—	—	1	—	1	—
Canada	2	—	—	—	—	1	1	1	1
Chili	1	—	1*	—	—	—	1	1	—
China	20	—	6	—	—	3	17	20	—
Colombia, S. A.	1	—	—	—	—	—	1	1	—
Cuba	1	—	—	—	—	1	—	1	—
Cyprus	2	—	—	—	—	2	—	2	—
Czechoslovakia	1	—	—	—	—	—	1	1	—
Danzig	1	—	—	—	—	1	—	1	—
Egypt	2	—	—	—	—	1	1	2	—
England	2	—	—	—	—	—	2	2	—
Finland	1	—	—	—	—	—	1	1	—
France	1	—	—	—	—	—	1	1	—
Germany	6	—	—	—	—	2	4	5	1
Greece	1	—	—	—	—	—	1	1	—
Hawaii	12	—	—	—	—	11	1	12	—
Holland	1	—	—	—	—	1	—	1	—
Hungary	1	—	—	—	—	—	1	1	—
Iceland	1	—	—	—	—	—	1	1	—
India	10	—	4**	—	—	3	7	10	—
Indonesia	1	—	—	—	—	—	1	1	—
Iran	3	—	—	—	—	1	2	3	—
Iraq	4	—	—	—	—	2	2	4	—
Israel	1	—	—	—	—	1	—	1	—
Italy	3	—	1	—	—	—	3	3	—
Japan	17	—	—	—	—	3	14	17	—
Java	1	—	—	—	—	—	1	1	—
Korea	2	—	—	—	—	—	2	2	—
Latvia	4	—	1	—	—	1	3	4	—
Lebanon	1	—	—	—	—	1	—	1	—
Mexico	1	—	—	—	—	1	—	1	—
Norway	1	—	—	—	—	1	—	1	—

Table I (Continued)

Country	Students	Active	Inactive	Fatal Form	Benign	Neg.	Pos.	Neg.	Pos.
						SKIN TESTS			
	No. of	Tuberculosis		Histoplasmosis		Tuberculin		Histoplasmin	
Pakistan	2	—	1	—	—	—	2	2	—
Peru	2	—	—	—	—	1	1	2	—
Phillipines	3	—	—	—	—	—	3	3	—
Poland	3	—	1	—	—	—	3	3	—
Puerto Rico	1	—	—	—	—	1	—	1	—
Russia	1	—	—	—	—	—	1	1	—
Siam	1	—	—	—	—	1	—	1	—
Spain	2	—	1	—	—	—	2	2	—
Sweden	3	—	—	—	—	2	1	3	—
Thailand	3	—	—	—	—	—	3	3	—
Turkey	2	—	—	—	—	—	2	2	—
Yugoslavia	1	—	—	—	—	—	1	1	—
TOTALS	136	00	16	00	00	44	92	134	2
PER CENT	100	00	11.7	00	00	32	68	98.6	1.4

*Became active nine months after enrollment. Sent home by plane.
**Two became active; one six months and the other 14 months after enrollment. The former is at Saranac Lake and the latter at our University Hospital.

TABLE II: Incidence of Tuberculosis and Histoplasmosis in United States Students Enrolling at Ohio State University from September 1950 to January 1952.

Country	No. of Students	Tuberculosis Active	Tuberculosis Inactive	Histoplasmosis Fatal Form	Histoplasmosis Benign	SKIN TESTS Tuberculin Neg.	Tuberculin Pos.	Histoplasmin Neg.	Histoplasmin Pos.
United States (85% Ohioans)	8,807	3	39	—	22	7,354	1,453	4,668	4,139
PER CENT	100	0.034	0.44	00	0.24	83.5	16.5	53	47
	100	0.47		0.24		83.5	16.5	53	47

Mississippi Valley States made up of Ohio, Indiana, Illinois, Kentucky, Tennessee, Missouri, Kansas, Arkansas, and Louisiana.

Of the 8,807 United States students in our study, 4,139, or 47 per cent, were histoplasmin reactors. Of this group 85 per cent were native Ohioans, and the average histoplasmin reactor rate throughout Ohio is 48.8 per cent.[6] Only two persons in the foreign student group were positive reactors to histoplasmin (Table I).

Healed benign pulmonary histoplasmosis, demonstrable on the x-ray film as enlarged and calcified hilar lymphnodes with single or multiple calcifications in the lung fields, was discovered in 2.4 per cent of the United States student group—21 cases from Ohio and one from Kentucky. None of the foreign students showed evidence of the disease in any form.

SUMMARY

1) Not a single case of active tuberculosis was found in foreign students enrolling at Ohio State University.

2) The same group had a much higher percentage of inactive demonstrable lesions on entrance to the university than the United States student group entering during the same period.

3) The foreign student group also had a much higher percentage of reactivations during their residence at Ohio State University than the enrollees from the United States.

4) The foreign group showed a much higher incidence of tuberculin reactors.

5) Lesions suggesting benign or healed histoplasmosis could only be demonstrated in the United States student group.

6) United States enrollees had a much greater percentage of histoplasmin reactors than the foreign student group.

7) *Lifetime residents of countries other than the United States and Canada were all negative reactors to histoplasmin.*

8) Our study suggests that persons from foreign countries may become histoplasmin reactors after living in any of the Mid-western or Mississippi Valley States.

RESUMEN

1) No se encontro un solo caso de tuberculosis activa entre los estudiantes extranjeros ingresados a la Universidad del Estado de Ohio.

2) El mismo grupo tenia un porcentaje mucho mayor de lesiones tuberculosas inactivas al entrar a la universidad que el grupo de estudiantes norte americanos que ingresaron en el mismo periodo.

3) El grupo de estudiantes extranjeros también presentó un porcentaje mucho mayor de reactivaciones durante su residencia en la Universidad de Ohio que los ingresados de los Estados Unidos.

4) El grupo extranjero mostró una frecuencia mucho mayor de respuestos positivos a la tuberculina.

5) Sólo en el grupo de los Estados Unidos pudieron encontrarse lesiones que sugerían histoplasmosis benigna o curada.

6) Los estudiantes norteamericanos tuvieron un porcentaje mucho mayor de respuestos positivos histoplasmin que los del grupo extranjero.

7) *Los que han pasado toda su vida en otros paises fuera del Canadá y de los Estados Unidos, fueron, todos, negativos a la histoplasmina.*

8) Nuestro estudio sugiere que las personas que provienen de paises extranjeros pueden tornarse reactores a la histoplasmina después de vivir en cualquiera de los estados del medio Oeste o en los estados del Valle del Misisipi.

RESUME

1) Il n'y à pas eu un seul cas de tuberculose active chez les étudiants étrangers qui commencent leurs études à l'Université de l'Etat de Ohio.

2) Ce groupe à une proportion beaucoup plus grande de lésions inactives

mais perceptibles lors de l'entrée à l'Université que les étudiants Américains qui furent inscrits pendant la même période.

3) Les étudiants étrangers eurent pendant leur séjour à l'Université de l'Etat de Ohio une beaucoup plus forte proportion de réactivations que les étudiants Américains.

4) Les étudiants étrangers se montrèrent dans une beaucoup plus grande proportion porteurs de réactions tuberculiniques positives.

5) Les lésions qui pouvaient faire penser à une histoplasmose bénigne ou guérie ne furent décelables que chez les étudiants Américains.

6) Les recrues de nationalité américaine ont dans une beaucoup plus grande proportion des réactions positives à l'histoplasmine que les étudiants étrangers.

7) *Ceux qui vécurent toute leur vie dans d'autres contrées que les Etats-Unis et le Canada avaient ous des réactions négatives à l'histoplasmine.*

8) Cette étude permet de penser que les individus d'origine étrangère ont des chances d'acquérir des réactions positives à l'histoplasmine après avoir vécu dans les états de l'Ouest ou de la vallée du Mississippi.

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Anatomic-Pathologic Comparative Study of Pulmonary Tuberculosis Deaths With and Without Streptomycin*

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The present study shows the anatomic-pathologic panorama of pulmonary tuberculosis and its repercussions in a period just prior to the employment of streptomycin. It also establishes comparisons with another group subjected to this therapy.

Since we felt that it would be more significant than other groupings, we have preferred to compare two periods of time, each of three years, taking for material deaths from pulmonary tuberculosis which occurred in the Bronchopulmonary Section of the Salvador Hospital. For this reason we have found ourselves with two groups which were numerically different, but at the same time more connected with the reality of the present day situation created by the employment of the antibiotics.

The anatomic-pathological studies were realized in the Instituto Patologico of the Salvador Hospital, whose Director is Dr. Ismael Mena. The study refers exclusively to the macroscopic aspect and is based on a detailed revision of the protocol of each autopsy, correlated with the corresponding clinical case record.

The terminology employed keeps as close as possible to the North American tuberculosis classifications, in accordance with the international agreements in force in this respect. A strict separation is maintained between primary infection forms and reinfection forms. This separation is due to the fact that in our country there exist at present sufficient clinical and anatomic-pathologic factors to make this procedure advisable for greater understanding. The same applies to the divisions between acute and chronic forms within the reinfection group.

The statistical analysis of the study was made under the direction of Dr. Benjamin Viel Vicuna.

Selection of Cases

The group corresponding to those cases not treated with streptomycin was taken from those deaths which were submitted to necropsies between October 1, 1945 and September 30, 1948. We have omitted deaths resulting from other causes, from non-pulmonary tuberculosis, or from accidents which interrupted the natural course of the illness. Nevertheless, it is necessary to put on record the fact that these omissions were very few. In reality, the material on which this part of the paper is based, represents almost the entire mortality occurring within the Section in this period of time. Since it was also possible to find all of the case history and autopsy records, no cases were lost or eliminated for these reasons. The total resulting was a group of 204 cases.

*From the Hospital Del Salvador, Santiago, Chile.

The group treated with streptomycin corresponds to deaths occurring between October 1, 1948 and September 30, 1951. These deaths totalled 111. However, in the study we have not taken into account 53 deaths corresponding to this period for the simple reason that they did not receive treatment with streptomycin. In addition, we have also eliminated two other cases because they either did not correspond to the etiology of tuberculosis or because the tuberculosis was extra-thoracic. We have left then for the purpose of the study, a group of 55 cases treated with streptomycin.

In the first place and along general lines it is worth noting that the mortality in this second period of three years came down almost to half. Also along general lines, we should like to point out that there is nothing strange in the fact that a high percentage of patients was not treated with streptomycin during the period between 1948 and 1951. The reasons were economic. Today it would be practically impossible to find a case of tuberculosis which has not been treated for some reason at some time with this antibiotic.

TOTAL DOSES OF STREPTOMYCIN

10 to 20 grs.	5 cases
20 to 30 grs.	8 cases
30 to 40 grs.	3 cases
40 to 60 grs.	10 cases
60 to 80 grs.	10 cases
80 to 100 grs.	3 cases
More than 100 grs.	16 cases

DAILY DOSE

1 gr. every other day	1 case
½ gr. per day	2 cases
1 gr. per day	46 cases
1½ gr. per day	6 cases

STATISTICAL RELATIONSHIP BETWEEN BOTH GROUPS

A — AGE

In Years	Not Treated with Streptomycin	Treated with Streptomycin
11-20	44	6
21-30	78	22
31-40	36	14
41-50	29	10
51-60	11	2
61-70	3	1
Average Age in Years	29.7	31.9
Standard deviation of the distribution	±12.2	±11.1
Standard deviation of the average	± 0.9	± 1.5

The average age of the group not treated with streptomycin is slightly lower than that of the group which received this therapy, but the difference observed might also be due to the factor of casualty since the value of x/s only reached 1.3. We can conclude that as regards age both groups are comparable.

B — SEX

	Men	Women	Total
With Streptomycin	138	63	201
Without Streptomycin	28	27	55

We note here that there is a larger proportion of men in the group not treated with streptomycin, but this fact does not correspond to any factor of selection; rather to a change in the distribution of the number of beds for the different sexes in the hospital.

RESULTS

A — PATHOGENIC PHASE

	Total	Acute Forms	Per cent
With Streptomycin	201	34	16.9
Without Streptomycin	55	1	1.8
TOTAL	256	35	13.7

We observe here a considerable decrease of acute forms in the group treated with streptomycin. This difference cannot be explained through the influence of casualty since the value of x/s is 2.4.

Since we have compared in this study two groups which are chronologically continuous, the strong reduction of the acute forms (an important characteristic of populations in an era of increasing or maximum tuberculinization) is an important point. In the acute reinfection type of tuberculosis it is possible to demonstrate, in the majority of the cases, an old focus (generally within the thoracic area) from which the bacilli are spread. It is therefore reasonable to suppose that streptomycin establishes a certain degree of blockade around this initial focus, thus impeding the process of disseminations of an acute type. This thesis is strengthened by the fact that the milliary spread and the sublobar focci of interpulmonary caseous pneumonias, the beginning point of the classically acute forms, are strongly diminished, as is shown in this study.

The average number of months between diagnosis and autopsy in the cases treated with streptomycin is larger than in the other group and the difference cannot be attributed to casualty since the value of x/s is 3.2.

In spite of the fact that all pulmonary tuberculosis in the cases studied was far-advanced, the use of streptomycin lengthened the course of the disease. The importance of this fact warrants a whole series of comments,

B — TIME LAPSE BETWEEN DIAGNOSIS AND AUTOPSY

Months	Not Treated with Streptomycin	Treated with Streptomycin
3- 6	72	6
7-12	53	12
13-24	39	12
25-36	15	9
37-48	4	7
49-120	18	9
Average Age in Months	17.3	30.4
Standard deviation of the distribution	±23.2	±26.9
Standard deviation of the average	± 1.6	± 3.7

from different aspects: the properly human approach, the coordination of therapies with streptomycin, and finally, and of special importance, the problem of increased contagion with the added risk that this be intensified with resistant strains of bacilli. Naturally, this latter problem acquires importance only in countries or areas where there is a lack of beds, as is the case in Chile.

C — CHARACTERISTICS OF THE PULMONARY LESIONS (CAVITIES)

Presence of Cavities

	Total	With Cavities	Per cent
Without Streptomycin	201	185	92.4
With Streptomycin	55	53	96.5
TOTAL	256	238	93.0

There is present here a higher percentage of cavities among the patients treated with streptomycin, but since the value of x/s is 1.1, the difference may possibly be explained through casuality.

Size of Cavities

	Total	Cavities Over 4 cm	Per cent
Without Streptomycin	201	95	47.1
With Streptomycin	55	48	87.2
TOTAL	256	143	56.0

The larger percentage of giant cavities among the group treated with streptomycin cannot be explained by casuality since the value of x/s is equal to 5.3.

Age of Cavity

	Total	Old Cavities	Per cent
Without Streptomycin	201	111	55.5
With Streptomycin	55	44	80.0
TOTAL	256	155	60.5

The greater proportion of old cavities in the patients treated with streptomycin and the difference between this group and the other cannot be explained by casuality since the value of x/s is 3.3.

Number of Cavities

Average number of cavities per patient in the group treated with streptomycin	3.8
Average number of cavities per patient in the group not treated with streptomycin	4.1

As the findings relative to the number of cavities are approximately equal no statistical analysis is required.

Since we are dealing with a group of far-advanced and progressive cases, the high percentage of patients with cavities is not surprising. Nevertheless, this high number is significant since the problem of the existence of cavities in the cases treated with antibiotics is one of great therapeutic responsibility. The lesser incidence of cavities of recent formation among the group treated with streptomycin makes one suppose that when the drug modifies the formation of caseous focci it impedes in some way the appearance of these progressive cavities of recent formation, whose basic lesion is of a caseous exudative infiltration type, but its effect is not equally noticeable in the existing cavities. The larger size and the characteristics of an older process noted in the cavities of those cases treated with streptomycin might possibly be due to the longer life of these patients, providing time which permits these changes to take place.

Pleural Complications

As regards pleural complications (adhesions and empyemas), there was no change between the two groups, it is not worth while to give further mention to this aspect.

Intrapulmonary Spread

The almost constant presence in all the chronic cases of a fibrocaseous process, generally cavernous, and found in the superior part of the lung, the site of the oldest lesions, is encountered without modification in both groups. This is true as regards characteristics and as to frequency. As regards the nodular dispersions which originated in the above process and then spread to the rest of the lungs, it was found that there was a more or less equal number of cases in both groups, but the characteristics and the number of nodules were totally different. Among the patients treated with streptomycin, these nodules took on a strongly fibrotic aspect

and at the same time were found to be enclosed in a fibrotic capsule. Their consistence and color were totally different from the exudative-caseous nodule found in the group not treated with streptomycin. Also, the number of nodules found among the streptomycin group was much smaller than in the other, the spread being much less pronounced and even on occasion respecting complete lobes and even a lung.

Together with the existence of these two processes, the most typical and constant found in deaths occurring from pulmonary tuberculosis of the chronic reinfection type, we often found small miliary dispersions and sublobar foci of caseous pneumonia. However, in order to reach a correct statistical analysis we shall proceed to add, in the next two tables, to the caseous foci present in the chronic forms the caseous acute forms.

Existence of Caseous Focci

	Total	With Caseous Focci	Per cent
Without Streptomycin	201	42	20.9
With Streptomycin	55	3	5.4
TOTAL	256	45	17.6

The decrease in caseous focci cannot be explained by casuality since the value of x/s reaches 2.7.

Existence of Miliary Dispersions

	Total	Miliaries	Per cent
Without Streptomycin	201	25	12.4
With Streptomycin	55	1	1.8
TOTAL	256	26	10.1

The decrease in the miliary dispersions cannot be explained by casuality either since the value of x/s is 2.3.

As regards the predominance of productive processes over the exudative processes or vice versa, the results found were as follows:

	With Streptomycin	Without Streptomycin
Predominately exudative	46 per cent	93.5 per cent
Predominately productive	54 per cent	6.5 per cent

D — LARINGEAL COMPLICATIONS

(Chronic reinfection pulmonary forms exclusively)

	Total	Laringeal Tuberc.	Per cent
Without Streptomycin	201	76	37.8
With Streptomycin	55	15	27.3
TOTAL	256	91	35.5

There was less largingeal tuberculosis among the group treated with streptomycin, but the difference observed could be produced by casuality since the value of x/s was only 1.4.

E — GLANDULAR COMPLICATIONS

(Chronic reinfection pulmonary forms exclusively)

	Total	Glandular Tuberc.	Per cent
Without Streptomycin	201	74	36.8
With Streptomycin	55	7	12.7
TOTAL	256	81	31.6

There was less glandular tuberculosis in the cases treated with streptomycin and since the value of x/s is equal to 3.4 the difference cannot be explained by casuality.

F — INTESTINAL COMPLICATIONS

(Chronic reinfection pulmonary forms exclusively)

	Total	Intestinal Tuberc.	Per cent
Without Streptomycin	201	149	74.1
With Streptomycin	55	13	23.6
TOTAL	256	162	63.3

There was less intestinal tuberculosis in the cases treated with streptomycin and since the value of x/s is 6.0 the difference cannot be attributed to casuality.

As regards the extension of the lesions and the existence of perforations our findings are significant.

	With Streptomycin	Without Streptomycin
Important lesional extensions	23 per cent	61 per cent
Intestinal perforations	0 per cent	3.75 per cent

G — HEPATIC COMPLICATIONS

(Both chronic and acute pulmonary forms)

	Total	Fatty Liver	Per cent
Without Streptomycin	201	39	19.4
With Streptomycin	55	2	3.6
TOTAL	256	41	16.0

There was less fatty liver in the cases treated with streptomycin and since the value of x/s is 2.8 the difference cannot be explained by casuality.

H — POLYSYSTEMATIC TUBERCULOSIS AND ISOLATED NODULAR SPREADS
(Chronic reinfection pulmonary forms exclusively)

	With Streptomycin	Without Streptomycin
Polysystematic type	5.5 per cent	15 per cent
Isolated nodular spreads	9.15 per cent	13 per cent
Meningitis	3.66 per cent	3.7 per cent
Tracheal ulcers	1.8 per cent	11 per cent

By polysystematic tuberculosis we mean processes where, together with the pulmonary lesion, other important lesions in extra-thoracic organs evolve simultaneously. By isolated nodular spread we refer to those isolated tubercules which on autopsy are found to be dispersed in several organs but have not reached any great development.

In the group treated with streptomycin there was a marked descent in the number of cases of polysystematic tuberculosis and of isolated nodular spreads. The same was true in regard to tracheal ulcers, but on the other hand, when we deal with meningitis complicating the evolution of a pulmonary tuberculosis we can find no appreciable difference between one group and the other.

SUMMARY

We have examined from an anatomic-pathological viewpoint two groups of pulmonary tuberculosis deaths, chronologically continuous but different: 204 not treated with streptomycin and 55 treated with streptomycin. Both groups were comparable as regards age and sex. No appreciable differences as regards pleural complications and meningitis were found. The cavities in the treated group were larger, older, and showed more frequent perforations in the pleura. In the same group, that is those treated with streptomycin, new cavities were less frequent.

Among the group which received streptomycin there was an increase in the total time of evolution of the pulmonary tuberculosis.

Also in the group treated with streptomycin there was a marked lowering of the glandular, laryngeal, pulmonary and intestinal disseminations produced through the lymphatic and the hematic systems as well as of those produced through the lumen of the different tracts.

Another marked lessening found in the group treated with streptomycin was in the amount of fatty livers.

The acute reinfection pulmonary forms disappeared almost completely in the group treated with streptomycin.

The most marked effect of the drug is the lessening of extrathoracic dispersions and the tendency to transform exudative processes into productive processes. On the other hand, the cavity problem does not respond to streptomycin. We can almost say that it is aggravated by use of the drug. For this reason, the responsibility for selecting therapies in the presence of cavernous tuberculosis has grown more serious with the advent

of the antibiotics. There now exist greater possibilities of a definite cure, but only if proper judgment is used in combining other therapies in support of streptomycin.

RESUMEN

Hemos examinado dos grupos de casos letales de tuberculosis pulmonar desde el punto de vista anatomopatológico; estos grupos son cronológicamente continuos pero diferentes: 204 no tratados con estreptomicina y 55 tratados con esa droga. Ambos grupos son comparables por la edad y el sexo. No se encontraron apreciables diferencias respecto de complicaciones pleurales y meningitis. Las cavidades en el grupo tratado eran mayores, mas antiguas y mas frecuentemente mostraron perforaciones pleurales. En este mismo grupo tratado, las cavidades nuevas fueron menos frecuentes.

En el grupo que recibió estreptomicina hubo un aumento del tiempo total de evolución de la tuberculosis pulmonar.

También se notó en el grupo tratado una marcada disminución de las diseminaciones ganglionares, laríngeas, pulmonares e intestinales producidas por las vías linfática y hemática, así como las producidas por la vía canalicular.

Otra marcada disminución fué la de la frecuencia de hígados grasos en los tratados con estreptomicina.

Las formas agudas de reinfección desaparecieron casi completamente en el grupo tratado. El efecto mas marcado de la droga es la menor frecuencia de las diseminaciones extratorácicas y la tendencia a transformar los procesos exudativos en productivos.

Por otra parte el problema de la cavidad no es resuelto por la estreptomicina. Casi podemos decir que es agravado por el uso de la droga. Por esto, la responsabilidad de la selección de la terapéutica en presencia de tuberculosis cavitaria ha venido a ser mas seria con el advenimiento de los antibióticos. Hay ahora mayores posibilidades de una curación definitiva pero solo si se juzga adecuadamente para combinar otros procedimientos de cura en apoyo de la estreptomicina.

RESUME

Nous avons examiné au point de vue anatomo-pathologique deux groupes d'individus morts de tuberculose pulmonaire: 204 n'avaient pas été traités par la streptomycine et 55 l'avaient été. Ces deux groupes étaient comparables au point de vue de l'âge et du sexe. Il n'y avait pas de différence appréciable au point de vue des complications pleurales ou méningées. Les cavités dans le groupe de malades traités étaient plus importantes, plus vieilles et s'accompagnaient plus fréquemment de perforations dans la plèvre. Dans ce même groupe, c'est-à-dire celui des malades traités par la streptomycine, les cavités jeunes étaient moins fréquentes.

Parmi les malades qui out reçu de la streptomycine, on notait une augmentation de la durée totale de l'évolution de la tuberculose pulmonaire.

De même, dans le groupe traité par la streptomycine, il y avait une diminution marquées des disséminations ganglionnaires, laryngées, pulmo-

naires et intestinales. Cette diminution portait aussi bien sur les dissémina-tions d'origine lymphatique ou se produisant par voie hématogène que sur celles qui étaient produites par voie canaliculaire.

Une autre diminution très nette constatée dans le groupe des malades traités porte sur le pourcentage des dégénérescences graisseuses du foie.

Les réinfections pulmonaires aigues semblant à peu près complètement absentes dans le groupe traité par la streptomycine.

L'effet le plus remarquable de la drogue est la diminution des localisa-tions extra-thoraciques et la tendance à transformer les processus exsudatifs en processus productifs. Par ailleurs, les cavernes ne sont pas influencées par la streptomycine. Nous pouvons presque dire que l'usage de ce produit les aggrave. C'est la raison pour laquelle le choix de la thérapeutique en présence de tuberculose cavitaire est devenu plus délicat depuis l'utilisation des antibiotiques. Il existe maintenant une plus grande possibilité de traitement radical mais uniquement si on sait utiliser de façon judicieuse la combinaison des autres traitements avec la streptomycine.

Tracheopathia Osteoplastica
Report of a Case

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Tracheopathia osteoplastica is not a common clinical entity. However, with the more liberal use of endoscopic examinations, sporadic cases are more frequently encountered. Without endoscopic aid the diagnosis can seldom be made antemortem, because the clinical picture and the x-ray findings may simulate so many other types of pulmonary pathology. This was clearly demonstrated by the case being reported here, in which the clinical picture simulated bronchiectasis and the x-ray examination revealed changes suggestive of bronchogenic malignancy.

When one considers the gross pathological findings associated with this disease, consisting of small spicule like nodulations of bony tissue beneath the mucous membrane and between the cartilaginous rings of the trachea and both main bronchi, progressing to the point to produce narrowing of the lumen of these structures in varying degrees, it is not difficult to understand how the end result could mimic different types of pulmonary disease.

According to Hiebaum,[1] Luschka first described this phenomenon in 1856, and his report was followed by a case reported by Wilks.[2] Hiebaum, in a review of the literature up to 1934, found the occurrence of more than 70 such tumors involving the trachea and 30 in the bronchi. The Jacksons[3] called attention to the fact that these tumors may often produce symptoms in the later stages of development.

Schnitzer,[4] in a study of records of material obtained at necropsy, found that tracheopathia osteoplastica was more prone to appear in the fifth and sixth decades than at other times of life, and usually was limited to the lower two-thirds of the trachea from where it might extend into either or both main bronchi. A peculiar characteristic is that the posterior or membranous portion of the trachea is often immune to this process of ossification.

Although several hypotheses have been advanced, the true etiological basis for development of osteoma in the trachea has not been established.

Clerf[5] reported two personal cases of tracheopathia osteoplastica in 1944. In both of his patients narrowing of the lower end of the trachea and both main bronchi was present. In one of these cases the narrowing was so marked that a 6 mm. bronchoscope could not be passed beyond the carina, and definite evidence of bilateral bronchiectasis existed. In neither of his cases was there present any ulceration of the mucous membrane.

Flick[6] recently reported a case upon which I had had the privilege of doing a bronchoscopic examination, and the diagnosis of tracheopathia osteoplastica was made on the basis of the unusual characteristic findings

at the time of the endoscopic inspection, and subsequently confirmed by histological study. Almost the identical findings were noted on endoscopic examination of the case here reported.

Case Report

H.T., white male, 68 years of age, a plumber by trade, was admitted to the Jewish Hospital on January 7, 1951 by Dr. Harry N. Stein with a history of a chronic cough of many years' duration, productive of thick, greenish sputum with a foul odor. His cough was most severe in the morning and the amount of sputum was greatest in the morning. He also had had five or six bouts of massive hemoptysis, and many episodes of blood streaked sputum.

He stated that he had been completely studied three years prior to this admission, and told that he had bronchiectasis. Subsequently he had had several hospital admissions for pneumonia. He had improved on penicillin therapy but this had to be discontinued because of severe allergic reaction.

Two weeks before admission the patient developed what he called "lumbago." Because of temperature elevation and chills he was hospitalized, and following admission to the hospital he ran a moderately elevated temperature.

Complete blood count showed hemoglobin 10.8 per cent; red blood cells 3,800,000; white cells 8,200; neutrophils 72 per cent; monocytes 9 per cent; lymphocytes 8 per cent; eosinophils 1 per cent and sedimentation rate 44.

Roentgenograms of the chest were reported as follows: "Examination of the chest reveals evidence of old fractures involving several of the right ribs posteriorly. Slight narrowing of several of the bodies of the upper dorsal vertebrae are noted. The cardiovascular silhouette appears normal. The right mid-lung field is occupied by a rather poorly defined hazy density. Though this could represent an area of pneumonitis, one obtains the impression that the horizontal fissure is slightly elevated; and because of this, the possibility of an atelectatic component in the right upper lobe, explaining this finding and possibly being caused by a bronchogenic malignancy, must also be considered. The chest appears otherwise essentially negative" (Figure 1).

Bronchoscopic examination of this patient revealed a most startling picture. The motility of the larynx was normal; the mucous membrane was moderately inflamed. The first 2 to 3 centimeters of trachea showed congestion of the mucous membrane but the lumen was practically normal in size and the mucous mem-

FIGURE 1

FIGURE 2

brane, although moderately inflamed, was smooth. Beyond this point the lumen assumed a conical appearance. On the anterior circumference there were tiny, blunt projections of spicule-like arrangement completely covered by moderately inflamed mucous membrane. A brittle scraping sensation was felt with the tip of the bronchoscope when passing over these irregular elevations. The lumen at the lower end of the trachea was about two-thirds normal size. This same type of changes could be seen within the lumina of the right and left main bronchi, and only the first portion of these structures could be explored with a 6 mm. bronchoscope. The wall of these structures appeared fixed and "stony." In view of our previous experience with a similar case we immediately recognized this as tracheopathia osteoplastica.

The secretions which were aspirated bronchoscopically were studied for tubercle bacilli and tumor cells, but were negative.

During hospitalization this patient showed definite clinical improvement of his pulmonary symptoms on antibiotic therapy, and was discharged on February 7, 1951 (Figure 2).

Following discharge from the hospital this patient moved from Philadelphia, so that we have not been able to follow his subsequent progress.

SUMMARY

1) Although tracheopathia osteoplastica is a rare clinical entity, more and more cases are being recognized antemortem because of the liberal use of endoscopic investigation.

2) Once the endoscopist has seen such a case he will never forget the typical picture of the blunt spicule like formation jutting out into the lumen of the lower trachea, like many miniature icebergs clustered together. The grating of the tip of the bronchoscope in passing over these irregular stony surfaces is also a memorable experience not easy to forget.

3) A case, presenting the typical endoscopic picture of tracheopathia osteoplastica is here presented.

RESUMEN

1) Aunque la treaquepatia osteoplástica es una entidad clínica rara cada vez se reconocen más casos antes de la muerte debido al mayor uso de la endoscopia.

2) Una vez que el endoscopista ha visto un caso de estos no olvidará jamás el aspecto típico de las formaciones de aparentes espículas romas sobresaliendo hacia la luz de la traquea inferior, como si fueran un grupo de "icebergs en miniatura." El frote del broncoscopio al pasar sobre estas soperficies irregulares y pétreas es también algo que no es facil olvidar.

3) Se presenta un caso con el aspecto endoscópico típico de la tragueopatia osteoplástica.

RESUME

1) Bien que la maladie ossifiante de la trachée soit une entité clinique rare, actuellement l'utilisation étendue de l'examen endoscopique permet d'en révéler sur le vivant des cas de plus en plus nombreux.

2) L'endoscopiste qui a vu une fois un tel cas n'en oubliera jamais l'aspect typique. Il s'agit de formations à pointes mousses faisant saillies dans la

lumière de la partie inférieure de la trachée, semblables à un grand nombre de petits icebergs en miniature soudés les uns aux autres. Le frottement de l'extrémité du bronchoscope passant sur ces saillies irrégulières est également une sensation que l'on n'oublie pas facilement.

3) Une observation dans laquelle on à constaté l'aspect endoscopique typique de la maladie ossifiante de la trachée est présentée par l'auteur.

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Report of a Case of Right Pneumothorax Following Induction of Pneumoperitoneum*

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With the increasing indications of therapeutic pneumoperitoneum and with the wider application of this method for the treatment of pulmonary tuberculosis in recent years, reports of various complications of this procedure are accumulating in the medical literature.

One of these complications is the appearance of right pneumothorax during pneumoperitoneum treatment. This complication has been reflected in medical literature during the last decade and the number of reported cases exceeds 20. In this paper we would like to report one more case of a right pneumothorax which occurred immediately after the induction of pneumoperitoneum and which differs in many respects from the cases already published.

Case Report: M.M., No. 4532. *History:* 34 year old white female admitted to the sanatorium on September 30, 1951 with the history of known pulmonary disease since June 1951, when she, following measles pneumonia, had a miniature x-ray film taken by a mobile unit which was reported to show evidence of pulmonary disease. This proved to be active pulmonary tuberculosis and she was admitted for treatment.

Family History: Parents, two sisters and six brothers living and well. No tuberculosis in family. *Personal History:* Mumps, chicken pox and whooping cough in childhood; measles in April 1951, complicated by pneumonia in April 1951. She had four pregnancies—three normal deliveries and one miscarriage. Three children are living and well. From January to June of 1951 she was a contact to two men found suffering from active tuberculosis, who were living in the same house and were using the same stairway.

On admission, examination revealed a rather emaciated white female, 163 cm. (5 feet 4 inches) tall and weighing 42.13 kiloglams (93 pounds) who offered no complaint except a slight productive cough and occasional chest pain. On physical examination the abnormal findings were: pallor of skin and mucous membranes, a slightly decreased resonance over the left apex on percussion, and few fine posttussive rales over the spine of the scapula and supraclavicular fossa at the end of expiration on auscultation. All other systems were essentially normal.

Chest x-ray film on admission revealed density over the left apex, extending to the lower border of the anterior projection of the first rib, with several small highlights, suggestive of cavitation. The remainder of the lung fields were normal. The left costophrenic sinus was slightly blunted. The right diaphragm was tented in the mid portion. The heart was within normal limits (Figure 1).

Sputum was positive on direct smear. Hemoglobin, 72 per cent; red blood cells, 4,430,000; white blood cells, 4,800. Differential: neutrophiles, 70; lymphocytes, 27; monocytes, 3; sedimentation rate, 18 mm. Urine: no sugar, no albumen; sediments within normal limit. Blood: negative for syphilis.

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Course in the Sanatorium: Her temperature ranged between 98 and 99 degrees F.; pulse between 70 and 96; respiration between 18 and 24 per minute. Amount of sputum was one-fourth cup daily. Her appetite was fair. Bowel movements were normal.

On October 11, 1951 induction of pneumoperitoneum by one of us (C.V.) was done under local novacain anesthesia with an 18 gauge needle which was inserted in the left upper quadrant. Five hundred cc. of air were given with a slight (plus 2) positive reading at the end of insufflation. Immediately after introduction of air, she complained of slight pressure in the right chest and pain in the right shoulder, which was considered as a normal pneumoperitoneum reaction. The day of pneumoperitoneum induction she was not fluoroscoped. In the afternoon she complained of slight dyspnea and tightness in her right chest. There was an absence of substernal pain, pressure and other signs of mediastinal emphysema.

The following day, fluoroscopy (H.H.B.) revealed the complete absence of air in the peritoneal cavity and was refilled with 700 cc. (H.H.B.). Initial reading was not obtained. She was still complaining of shortness of breath, slight pain and tightness in the right chest. Fluoroscopy a day after, on October 13, 1951, by both of us, again revealed an absence of pneumoperitoneum but the presence of a right pneumothorax with 40 per cent collapse. As she was complaining of only slight dyspnea, the air was not removed and after a reasonable period of time left pneumothorax was started and has been maintained to date. The right lung has completely re-expanded (Figure 2).

Comment: This case resembles those previously published—pneumothorax occurred during pneumoperitoneum treatment and developed on the right side. However, it differs in many respects from the previous cases of this kind. Many authors have pointed out the importance of the length of time between institution of pneumoperitoneum and development of complications as a condition which predisposes this complication. Due to prolonged pneumoperitoneum treatment, often associated with phrenic crushes, the stretching of the diaphragm, atrophic and degenerative processes of the diaphragmatic muscle and formation of blebs on the diaphragmatic surface may occur. All of these processes and especially the formation of blebs facilitate the formation of hernias and shunts between peritoneal and pleural cavities with the escape of air.[1-3] For instance this

FIGURE 1 FIGURE 2

Figures 1 and 2: There is a right-sided pneumothorax which appears to be seen on the left side because x-rays at this institution are taken in a different manner.

complication occurred after one year of pneumoperitoneum treatments in the case of Banyai and Jurgens[4]; in the case of Yannitelli and associates[1] it occurred 10 months after induction of pneumoperitoneum and 20 days after the last refill; in the case of Ross and Farber[2] between the institution of pneumoperitoneum and occurrance of right pneumothorax more than one year elapsed, and in one of these cases phrenic crush was performed. In the case of Repa and Jacobson,[3] pneumothorax occurred after 14½ months after pneumoperitoneum was started, a year after a phrenic crush and 13 days after the last refill. In our case the time interval was absent.

Although right sided pneumothorax was discovered only 48 hours after pneumoperitoneum induction, pain in the right chest and dyspnea almost immediately after the induction of pneumoperitoneum, and the absence of air in the peritoneal cavity 24 hours after the induction, make very probable the possibility of pneumothorax development immediately following the beginning of treatment. The factors mentioned by some of the authors[1-3] as—a prolonged pneumoperitoneum treatment, phrenic crush, continuous stretching of the diaphragm, degeneration, atrophy, and inflammation of the diaphragm and bleb formation—do not apply to our case.

Also different in our case from those previously published is the development of pneumothorax shortly or even immediately after the insufflation and not after a longer period of time (20 and 13 days respectively).[1-3] Thus, Anderson's explanation, accepted by some authors[1-3] as one of the possible mechanisms of pneumothorax formation after pneumoperitoneum, does not apply to our case. Anderson[5] explains the tendency for penetration of air from the peritoneum into the pleural cavity by the differences in pressures in both cavities. According to Anderson's opinion the intrapleural pressure increases immediately after pneumoperitoneum refills and gradually drops during the following days. The longer the time interval after pneumoperitoneum refills, the greater the difference of pressures in both abdominal and thoracic cavities and the greater is the possibility of pleuroperitoneal shunt formation. Also the absence of symptoms and signs of mediastinal emphysema and the presence of right pneumothorax (spontaneous pneumothorax, accompanying mediastinal emphysema, is almost always located on the left side according to Dickie, cited by[2]) makes improbable the possibility of the mechanism given by Banyai[4] for the explanation of the complication under discussion. (Banyai thinks the air enters the mediastinum along the large mediastinal structures, causing mediastinal emphysema, and then pneumothorax, by escaping from the mediastinum into the pleural cavity.)

There are no indications or leads in the history indicative of some previous inflammatory process (e.g. subdiaphragmatic abscess), which might have explained the weakness of the diaphragm. Also completely excluded is the possibility of entering the pleural space by the 18 gauge needle[4]—(Pneumoperitoneum was induced on the left side)—or any other kind of injury or trauma.

Many authors consider increased physical activity or physical strain as a predisposing factor for the development of this complication. Physical

strain and activity were made partially responsible for this complication[1-3] and also taken into consideration in almost all previously reported cases. There was no activity, however, in our case. Since admission the patient has been on absolute bed rest.

Our case resembles that published by Wu and Neptune[6] and like them we are inclined to explain it by the presence of a congenital diaphragmatic defect. The displacement of the liver due to the pneumoperitoneum procedure and stretching of ligaments might have led to widening of a pre-existing diaphragmatic defect and permit the escape of air directly from the peritoneal to the pleural cavity. The fact of liver displacement and stretching of ligaments might explain the occurrence of pneumothorax on the right side.

According to Meyer,[7] the weak points in the diaphragm which are the most common sites of diaphragmatic hernias, and thus might be a source of direct communication between the peritoneal and pleural cavities, are:

1) Foramen of Bochdalek, which is a pleuro-peritoneal hiatus, situated dorso-laterally. The apex is curved toward the central tendon, upward and forward, and the base is turned downward and backward and partially rests on the 12th rib.

2) Outer crus. There may be a triangular space which separates the muscle fibers of the outer crura of the lumbar portion and the last muscular portion of the costal portion of the diaphragm. This space is filled by connective tissue and covered above by the pleura and below by the peritoneum. The liver plays a protective role on the right, and hernias through this opening occur mostly on the left. We think that the displacement of the liver in pneumoperitoneum may remove this protection and facilitate the formation of right hernia and shunt.

3) Foramina of Morgagni or Larrey's spaces, which are the spaces on both sides of the xiphoid process due to the failure of fusion of the sternal portion with the costal portion of the diaphragm. They are filled with the areolar tissue and covered above with pleura and below with peritoneum. All of these spaces are possible sources of diaphragmatic herniae and pleuro-peritoneal shunts. According to Meyer the foramina for the aorta, vena cava, esophagus, splanchnic nerves and azygos veins are not sites for herniae.

We believe that one of the first three congenital defects and displacement of the liver to be responsible for the occurrence of the right pneumothorax in our case.

SUMMARY

A case of right pneumothorax which occurred immediately after the induction of pneumoperitoneum is explained by a congenital diaphragmatic defect.

RESUMEN

Se explica la aparición de un neumotorax intrapleural que ocurrió inmediatamente después de la inducción de neumoperitoneo, por la existencia de un defecto diafragmático congénito.

RESUME

Un cas de pneumothorax droit qui survint immédiatement après la création d'un pneumopéritoine semble pouvoir être expliqué par une malformation congénitale du diaphragme.

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Spontaneous Hemopneumothorax with Early Thoracotomy: Case Report

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All but the most severe cases of spontaneous hemopneumothorax respond to conservative medical management. This consists chiefly of bed rest, analgesics, oxygen, transfusion, and thoracentesis. These measures combat the shock and cardiorespiratory embarrassment which accompany massive intrapleural bleeding or tension pneumothorax. Once this has been accomplished, therapy is concerned with controlling the bleeding and causing rapid reexpansion of the lung. Hemorrhage generally stops spontaneously in 24 to 72 hours.[1-3] Frequent thoracentesis permits the lung to reexpand.

If bleeding continues unabated, early death, long convalescence, or late complications of unexpandable lung and fibrothorax may result.[4,5] It has been suggested that thoracoscopy and cauterization of the bleeding vessel be tried.[6-8] The more practical approach of exploratory thoracotomy was reported by Myer, Johnston, and Bradshaw in March of 1951.[9] In their patient, they successfully located and controlled the bleeding vessel. A similar case was reported by Beatty and Frelick[1] in April of 1951. They found fresh blood oozing from torn pleural adhesions. The use of ligatures and gelfoam effected a favorable result.

We wish to present a similar case emphasizing the importance of early thoracotomy for uncontrolled bleeding in spontaneous hemopneumothorax.

Case Report

C.C., a healthy 27 year old, white, newspaper pressman suddenly developed shortness of breath and pain in the left side of his chest. The next day his physician treated him symptomatically. Dyspnea was alleviated, but the pain persisted. Late that evening the pain became severe and dyspnea returned. He became weak, began to sweat profusely, and felt faint. He was hospitalized.

He denied any previous unusual or strenuous physical activity except for some sneezing. He had experienced two similar episodes of chest pain during the previous year, once becaming quite breathless. Both were of brief duration and required only symptomatic therapy. There was no personal or family history of lung disease. Some years before, he had resided in areas of Arizona and California where coccidiomycosis is endemic.

Physical examination revealed a tall, well developed, but poorly nourished, pale, apprehensive, acutely ill male. He was orthopneic. His temperature was 100 degrees F. orally; respiratory rate, 32 per minute; pulse rate, 130 per minute. His blood pressure was 90 mm. of mercury, systolic and 60 mm. of mercury, diastolic. The skin and mucous membranes were pale. The trachea was deviated to the right.

Other pertinent physical signs were limited to the chest. The left thorax bulged and was immobile. There was flatness and absent breath sounds below the scapula. Anteriorly and superiorly, the left thorax was hyperresonant; breath sounds had a distant vesicular quality. The apex of the heart could not be located.

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The patient was given oxygen by mask and whole blood intravenously. On thoracentesis 500 cc. of dark fluid blood was recovered. This contained 9.7 grams per cent of hemoglobin and 3,370,000 erythrocytes per cu. mm. Venous blood taken from his arm had 9.0 grams per cent of hemoglobin; 3,170,000 R.B.C.'s and 25,900 W.B.C.'s per cu. mm. Bleeding and clotting times were normal. Roentgenograms demonstrated extensive "left hydropneumothorax" (Figure 1). Skin tests for tuberculosis and histoplasmosis were negative; test with coccidioidin, 1-100 dilution, was positive.

During the next three days, he was treated with strict bed rest, codeine for pain, oxygen, and transfusions. Penicillin and vitamin K were given empirically. More than 5,000 cc. of bloody fluid was removed by repeated thoracentesis. During this period, he received five liters of whole blood by transfusion. With these measures dyspnea diminished, the pulse rate slowed, and blood pressure returned to normal.

As noted above, enormous amounts of bloody fluid had to be aspirated each day. Daily hemograms remained unchanged despite transfusions. Furthermore, roentgenograms demonstrated persistence of the hemopneumothorax (Figure 2). Since it was obvious that the bleeding had not been controlled, exploratory thoracotomy was done on the fourth hospital day.

On opening the pleural cavity, a large blood clot was found occupying three-quarters of the space. It was removed, leaving behind considerable free bloody fluid. An emphysematous bleb, the size of an almond, was located in the superior segment of the lower lobe. Clotted blood adhered to the bleb, but no active bleeding was noted in this area. The lung was retracted inferiorly, bringing into view pleural adhesions that extended anteriorly from the apical segment of the upper lobe to the chest wall in the region of the subclavian vessels. Fresh blood oozed from these bands. This was controlled with electocautery. Since no further bleeding was noted, the bleb was excised and the operative chest wound repaired.

The patient improved rapidly. Within four days, his lung was totally reexpanded. Eight days postoperatively, he was asymptomatic. The left lung field appeared improved roentgenographically (Figure 3). He asked about returning to work. At present, the patient is in good health and working. The lung fields now appear clear on fluoroscopy.

Microscopic examination of the surgical specimen (Dr. Paul Michael) showed the following: The large blood clot presented evidence of beginning organization.

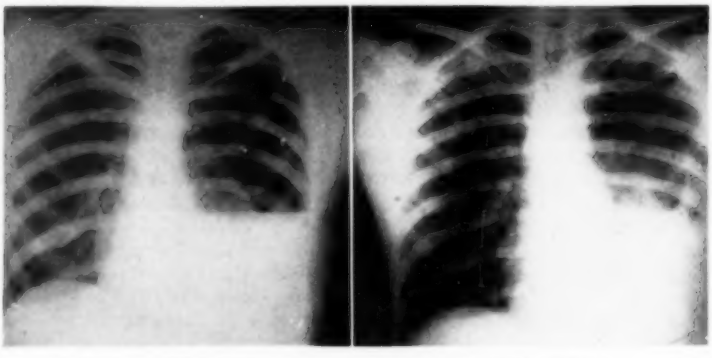

FIGURE 1 FIGURE 2

Figure 1: October 19, 1951. Large hemopneumothorax on the left with a fluid level in the fourth interspace anteriorly. The heart is displaced to the right.—*Figure 2:* October 22, 1951. The hemopneumothorax persists with a fluid level in the fourth interspace anteriorly. This overlies an irregular density in the left mid-lung field which represents compressed lung tissue and intrapleural blood clot.

The resected pulmonary tissue contained a bleb lined by flattened epithelial cells. The tissue surrounding the bleb was fibrotic, containing numerous fibroblasts and histiocytes. It was also quite vascular, and there had been hemorrhage into it.

Discussion

Spontaneous hemopneumothorax usually occurs in apparently healthy but undernourished males between 20 and 40 years of age.[7,10-12] Ordinarily no physical exertion precedes its occurrence, but a history of previous uncomplicated spontaneous pneumothorax is not uncommon. The onset of spontaneous hemopneumothorax may be abrupt or insidious. The typical initial symptoms of pain and dyspnea may diminish in intensity only to recur suddenly and violently. This has been explained as follows: Rupture of an emphysematous bleb, pleural bulla, or valve-vesicle leads to the original spontaneous pneumothorax. This, in turn, puts stress and strain on pleural adhesions.[5] As a result, the adhesions are torn, producing intrapleural hemorrhage and, often, further pneumothorax. Sometimes bleeding arises directly from the walls of a ruptured bleb or bulla.[7,10] In either case, symptoms of blood loss and shock may follow.

The earliest abnormal physical signs are typical of pneumothorax. These are followed by signs of hydrothorax in dependent portions of the chest after sufficient blood has collected in the pleural cavity. With further blood loss, generalized pallor and shock appear. Roentgenograms delineate the extent of the hemopneumothorax. Thoracentesis with recovery of frank blood clinches the diagnosis.

Persistent severe hemorrhage such as occurred in our patient is most often due to torn pleural adhesions[9] which receive their blood supply from

FIGURE 3: October 30, 1951. Postoperative film. The lung has reexpanded. Pleural density is present in the left base.

the intercostal vessels. For this reason they are subject to the higher, dynamic blood pressures of the systemic circulation. The parietal end of such a torn adhesion band is not affected by collapse of the lung. If this band is not completely severed, the tension of a partially retracted lung may serve to keep a bleeding vessel open. In contrast to this, bleeding from the lung parenchyma usually ceases with collapse of the lung even when its source is from the bronchial vessels of the systemic circulation.[8,10] Blood loss from these sources can be huge. In our case, more than 5,000 cc. of frank bloody fluid was recovered during the first four days of treatment. This emphasizes the need for transfusion.

In view of the underlying pathology, early exploratory thoracotomy would appear to be the therapeutic approach of choice when severe hemorrhage persists in spontaneous hemopneumothorax. It is advantageous since it allows adequate inspection, direct ligation or electrocoagulation of actively bleeding vessels, and definitive treatment for associated pathological lesions. In addition fibrin, clot, and exudate may be removed. This helps prevent the late complications which necessitate pulmonary decortication. With proper postoperative care, reexpansion of the lung is rapid and considerably shortens the usual period of disability. In the future, we intend to employ this procedure earlier when massive intrapleural hemorrhage persists.

From a review of the literature, it would seem that the prognosis of spontaneous hemopneumothorax is excellent if the diagnosis is made early and if proper treatment is employed. Recurrence of this disease has not been reported to date. This is probably due to the pleural symphysis that follows intrapleural hemorrhage.

SUMMARY

A case of spontaneous hemopneumothorax is reported. Intrapleural bleeding was persistent and totaled more than five liters. Early transfusion and thoracentesis were lifesaving. On exploratory thoracotomy, fresh blood was seen oozing from pleural adhesions. This was controlled by electrocautery. In addition, an emphysematous bleb was found and resected. Thoracotomy permitted control of the bleeding and considerably shortened the usual period of disability.

RESUMEN

Se relata un caso de hemo-neumotórax espontáneo. La hemorragia intrapleural fué persistente llegó a un total de más de cinco litros. La transfusión inmediata y la toracentesis le salvaron la vida. A la exploración por toracotomía se vió sangre fresca escurriendo de adherencias pleurales. Esto fué dominado por el electro cauterio. Además, se encontró un bula enfisematosa que fué resecada. La toracotomía permitió el control de la hemorragia y acortó considerablemente el tiempo habitual de incapacidad.

RESUME

Les auteurs rapportent un cas d'hémopneumothorax spontané L'hémorragie intrapleurale persista et totalisa plus de cinq litres. Une transfusion

précoce et une thoracentèse permirent de sauver la vie du malade. Lors d'une thoracotomie exploratrice on vit du sang frais suinter de brides pleurales. Ceci fut jugulé par électrocoagulation. En outre, on trouva et enleva une bulle emphysémateuse. La thoracotomie permit l'arrêt de l'hémorragie et reccourcit considérablement la période habituelle d'invalidité.

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Tuberculosis of the Tongue Treated with Streptomycin and PAS*

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Tuberculosis of the tongue may well be considered a rarity since less than 500 cases have been reported. Statistics vary considerably as to its incidence, but it is probable that the complication would be less rare were more attention given to the tongue upon examination of the patient and at the autopsy table.

It is generally agreed that the lingual form of tuberculosis is found less frequently in the colored than in the white race. Indeed, some authors[1,2] state that no case has been described in the negro. The lesion, however, occurs more frequently in the male than in the female and no age is exempt, as a case has been described in a child five and one-half years of age and in a man of 80 years, where the tongue had been amputated following the erroneous diagnosis of carcinoma.[3]

The onset of the lesion is insidious. The patient may complain of difficulty in articulation and in swallowing, and examination reveals some enlargement and thickening of the tongue. Later a focal point may be localized and softening takes place to be succeeded by ulceration. Little, if any pain is felt prior to ulceration, after which, as a rule, excruciating pain is generally continuously present.

Tuberculosis of the tongue must be differentiated from toxic glossitis, syphilis, carcinoma and other neoplasms. While epthous ulcers usually yield to rather simple remedies, the differentiation of tuberculosis and syphilis may be difficult as the patient may have both a tuberculin and a blood reaction. A thorough physical examination, roentgenograms of the chest and intensive sputum studies should be done for obvious reasons. Since cervical adenopathy may occur in both conditions, little reliance may be placed upon enlargement of the nodes. Biopsy examination, while often informative, is not always conclusive, as the microscopic differentiation is sometimes not possible. As a rule tubercle bacilli are not easily demonstrable by histological study of biopsy material.

Before the use of streptomycin, para-aminosalicylic acid, etc., the prognosis was poor, and not enough cases treated with these drugs have been reported to warrant any definite conclusion as to their value. Judging by analogy, however, we feel justified in anticipating much.

Although the comparative rarety of muscular tissue to infection by the tubercle bacillus, the movements of the tongue and the bactericidal action of the sputum have all, singly or in combination, been cited to account for the rarity of the lingual tuberculosis, nothing has been proved. Infec-

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tion may take place (1) by direct invasion; (2) by an abrasion of the mucous membrane; (3) by extension from tuberculous laryngitis, or lesions of the oral cavity; (4) by the blood vessels; (5) by the lymphatics. Primary infection, while considered possible theoretically, is generally thought to be improbable.

The tuberculous ulcer with its sinous, irregular, reddened edges usually discharges a yellowish pus and unless secondary infections have taken place, presents little or none of the induration so characteristic of malignancy. The floor of the ulcer presents rather pale, watery granulations. A fissure apparently may be more than an insignificant crack in the mucous membrane, but it varies in length and the depth is sometimes surprisingly great; the edges are usually undermined. These may slough off to form a ragged, irregular ulcer.

Extraction of carious teeth and smoothing rough dentures have been reported to have brought about healing of the ulcer. The use of cocaine has been advocated, not because of any curative effect, but, merely to permit the patient to swallow and thereby, perhaps, improve his general condition. Local application of silver nitrate sometimes produces temporary relief but is often followed by a relapse with greater ulceration. Healing of the ulcer by treatment with ultraviolet light treatment has been reported, and tuberculin has been used by several authors with favorable results. Surgery, ranging from partial to complete amputation of the tongue together with removal of the cervical glands, has been performed but none of the treatments has met with general approval.

Because of the rarity of the condition there are but few cases in the literature which have been treated with streptomycin and para-aminosalicylic acid. Shamaskin[4] reported three cases in 1947, one of which healed without relapse. In 1948 Wolfer, Hirschleifer and Shapira[5] reported a case which cleared up following the use of streptomycin, and a more recent paper of Schneider also reports improvement of the lesion.[6]

Case Report

S.G., a white male, 37 years of age, was admitted to Mont Alto Sanatorium, December 5, 1950, with loss of weight, a moderate cough, profuse sputum (Gaffsky vi) and sore tongue. His temperature ranged from 99.8 to 100.4 degrees F., pulse from 88 to 100 and respirations 24 per minute. He had 3,970,000 red blood cells and 7,600 white cells of which 75 per cent were polymorphonuclears, and 25 per cent lymphocytes; the hemoglobin was 75 per cent and the sedimentation rate was 27 mm. of a markedly active type in one hour. The Kahn test was negative. The family and past history were without significance. An x-ray film of the chest showed far advanced pulmonary tuberculosis with definite cavitation on the right and suggestive cavitation on the left side.

He gave a history of having been struck on the back of the left hand about 15 months before but although the hand pained from time to time, it began to swell only a few months before admission. An alert surgeon, whom he consulted, made the diagnosis of tuberculous osteomyelitis, and an x-ray film of the chest revealed the pulmonary condition. He also told of having had a fish bone stick in his tongue about a year before admission and that about two months later he noticed a "pimple" at the same place, shortly after which an ulcer developed. Upon admission to Mont Alto Sanatorium there was a draining sinus leading to the fourth

left metacarpal bone and a ragged, irregular ulcer, at least 3 cm. in diameter, was found in the anterior mid-dorsal surface of the tongue (Figure 1). The edges were reddened and undermined and a rather tenacious, mucopurulent discharge covered the area. There was no enlargement of the lymph nodes, and the larynx was not involved. The diagnosis of tuberculosis of the tongue was confirmed by biopsy examination.

He was given streptomycin, one-fourth gram, intramuscularly, twice a day for six weeks, at the end of which time the same dosage of streptomycin, combined with para-aminosalicylic acid solution (gram iii, q.i.d.) was given for 12 weeks. At the time of admission the tongue was sprayed with a 2 per cent solution before each meal to allay the pain, but by the end of the second week of the first course of streptomycin the ulcer had healed sufficiently to enable him to swallow without pain, and the cocain spray was discontinued. He gained 16 pounds and his temperature, pulse and respiration were within normal limits during the last two weeks of his stay at the sanatorium. An x-ray film of the chest, taken on April 24, 1951, showed retrogression of the disease of both lungs. Although, the sputum remained positive the ulcer on the tongue healed completely, leaving a well epithelialized fissure (Figure 2) and the sinus of the hand closed before he left Mont Alto Sanatorium, July 1, 1951, "Against Medical Advice."

FIGURE 1

FIGURE 2

Figure 1 (December 10, 1950), shows extensive ulceration of the dorsum of the tongue.—*Figure 2* (March 31, 1951), shows healing of the ulcer. The fissure was not as deep as it appears but was quite shallow.

Comment

Although correctly considered a rare complication of pulmonary tuberculosis, tuberculosis of the tongue is probably not so uncommon as the number of cases reported would indicate. More complete and thorough examination of the tongue and more correct diagnosis and reporting the condition, when found, while not proving it to be a common one, will likely prove it to be less rare than is generally believed. It is anticipated that the bacteriostasis produced by streptomycin and para-aminosalicylic acid, by increasing the individuals resistance, will prove these drugs superior to any used heretofore.

SUMMARY

A case of far advanced bilateral pulmonary tuberculosis, complicated by osteomyelitis of the fourth, left metacarpal bone and ulceration of the tongue has been presented. The improvement of the pulmonary involvement, closure of the sinus of the hand and healing of the ulcer followed the use of streptomycin and PAS. The importance of a correct diagnosis has been shown, and the necessity of chest x-rays whenever any suspicious lesions are present is shown by this case.

RESUMEN

Se presenta un caso de tuberculosis pulmonar bilateral complicado con osteomielitis del cuarto metacarpiano izquierdo y ulceración de la lengua. La mejoría del padecimiento pulmonar, cierre de la fístula en la mano y curación de la úlcera, se observaron después del uso de estreptomicina y PAS. La importancia del diagnóstico correcto se demuestra así como la necesidad de radiografía del torax cuando hay lesiones sospechosas.

RESUME

L'auteur rapporte une observation de tuberculose pulmonaire bilatérale grave compliquée d'une atteinte du quatrième métacarpien gauche, et d'une ulcération de la langue. L'utilisation de streptomycine et de P.A.S. a permis l'amélioration de l'atteinte pulmonaire, la fermeture de la fistule de la localisation osseuse de la main, et la guérison de l'ulcère lingual. Il montre l'importance d'un diagnostic correct, et la nécessité de l'examen radiologique du thorax chaque fois qu'une atteinte pulmonaire est soupçonnée.

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Editorial

Dr. Leo V. Schneider, Chief, Tuberculosis Control Section, Tuberculosis Division, United States Veterans Administration, has set a fine example for all hospitals and clinics throughout the world. The program he directs consists of making routine chest x-ray film inspections of all chronic, general and neuropsychiatric hospitalized veterans at the time of admission and at least every 12 months as long as they are institutionalized. Moreover, each veteran who reports to an out patient clinic has a chest x-ray film inspection at the time of his scheduled examination, if none has been made within six months.

All employees in regional offices and hospitals have x-ray film inspections of their chests at the time of employment, when transferred to other installations and when they discontinue work. While employed, x-ray films are made at six to 12 month intervals. At the time of employment, each employee also receives an intracutaneous tuberculin test.

In this manner, nearly one million veteran patients and personnel are screened each year for diseases of the chest. This actually represents a continuous "mass survey" sufficient in scope to those in large industries and extensive communities.

This program was fully implemented in September, 1949. Beginning with October of that year, complete reporting and follow-up studies were established. During the first 39 months, over two and one half million persons were so studied. Of these 2,011,918 were patients, and 534,434 were employees. Of the total group of patients and employees, 11,171 (0.4 per cent) were diagnosed as having active, and 31,825 (1.24 per cent) as having inactive pulmonary tuberculosis. Thus, each month 65,300 persons were surveyed and approximately 285 active and 815 inactive cases of pulmonary tuberculosis were reported.

Final diagnoses are not made from x-ray shadows alone, but from complete examination of those with shadow-casting lesions, including laboratory and clinic evidence, as well as serial x-ray film studies as indicated. Diagnoses, therefore, result from the combined efforts of roentgenologists, clinicians, laboratorians, bronchoscopists, and others who do special phases of examinations.

Nontuberculous diseases, such as lung tumors, cardiovascular abnormalities, etc., are also observed and are promptly given appropriate attention.

The routine, periodic chest examinations of personnel, both professional and nonprofessional during this 30-month period revealed 335 (1 to 1,000) cases of active tuberculosis, which is similar to that usually reported for adults examined in community wide and industrial surveys. Almost 4,000 (approximately 1 per cent) showed evidence of inactive disease. For these persons, more careful supervision was immediately instituted, and in some instances more appropriate assignments were made.

No significant difference was observed in the prevalence of active tuberculosis among personnel employed in the regional offices, neuropsychiatric, tuberculosis, and general medical service hospitals. However, the rate of

inactive tuberculosis was significantly higher among personnel employed in tuberculosis hospitals. It is thought that one reason for this latter finding may be that some persons with arrested tuberculosis by their own choice prefer employment in a tuberculosis hospital where they find a better understanding of their disease.

There can be no doubt that this excellent program will reduce the incidence of tuberculosis among veterans and their families, and will also influence the morbidity and mortality rate of the general population of the United States. In fact, there is already evidence of a decline in prevalence among groups surveyed during the 30-months period, which is particularly demonstrated among employees. This program has been so productive that it is being perpetuated. Moreover, it is being refined, intensified and enlarged.

The Tuberculosis Division of the United States Veterans Administration has achieved an enviable record in diagnosis, treatment and prevention of tuberculosis. Moreover, its research program has produced much important knowledge concerning this disease.

The leadership of John B. Barnwell in the over-all tuberculosis problem among veterans, and of Leo Schneider in the control section is justly receiving world wide recognition. Their methods are fundamental, thoroughly sound and are applicable not only to veterans, but also to people in all walks of life everywhere.

J. Arthur Myers.

Reunion in New York City

NINETEENTH ANNUAL MEETING OF THE COLLEGE

The Nineteenth Annual Meeting of the College will be held May 28 through 31, at the Hotel New Yorker, New York City. This is the first time in many years that the College meeting has been held in New York City and we anticipate a well attended, successful meeting. There are many things to do and many places to go in New York, which is an additional incentive to attend the meeting.

On Wednesday, May 27, the day prior to the official opening of the meeting, a number of seminars on various subjects will be presented as a part of the medical education program of the College. The following day, Thursday, May 28, will be given over mainly to administrative meetings. At noon there will be the luncheon of the Conference of College Chapter Officials which will be attended also by Officers, Regents, Governors and Council and Committee members. All interested members are invited to attend the luncheon and become acquainted with the activities of the College. In the evening the opening scientific session will be presented.

The scientific sessions will continue through Friday, Saturday and Sunday, May 29, 30 and 31, including round table luncheon discussions, an x-ray conference, a motion picture session and a number of panel discussions on subjects of particular interest at this time in the field of diseases of the chest.

On the social side, the Convocation, cocktail party and Presidents' Banquet, to be followed by dancing and entertainment sponsored by the New York Chapter of the College, will be held on Saturday evening, May 30. Many prominent physicians and scientists will be introduced at these functions, whom we are sure you will want to meet. Among them will be the recipient of the 1953 College Gold Medal.

The Ladies Reception Committee has arranged a number of delightful activities for the ladies attending the annual meeting. We know that your wife will be pleased with the plans which have been made for her and we hope that if it is possible, she will accompany you to New York City.

The annual meeting of the American Medical Association will be held June 1 through 5 in New York City. The Waldorf Astoria Hotel will be its headquarters and many of the other New York hotels will be used for the various session meetings. The Section on Diseases of the Chest of the American Medical Association will meet at the Hotel New Yorker on Tuesday and Wednesday, June 2 and 3, and the joint meeting with the Section on General Practice will be held at the Biltmore Hotel on Thursday, June 4. The scientific and technical exhibits will be located in the grand Central Palace.

We know that you will enjoy renewing acquaintances and making new friends, as well as enhancing your scientific knowledge, at the annual reunion of the College.

ANNOUNCEMENT

The Cook County Graduate School of Medicine announces a two-week intensive course on "The Diagnosis and Treatment of Congenital and Rheumatic Heart Disease in Infants and Children" presented by Benjamin M. Gasul, M.D. and Egbert H. Fell, M.D., and associates, May 18-30, 1953. For information write to: Registrar, Cook County Graduate School of Medicine, 707 S. Wood St., Chicago, Ill.

CORRECTION IN 1952 COLLEGE DIRECTORY

On page 261 of the 1952 Directory of the College under the listing for Dr. Felix R. Park, 401 Medical Arts Building, Tulsa, Oklahoma, there appears a notice that he is not in private practice. It should read "private practice full time."

Report of the Joint Committee on Chest X-Ray*

PURPOSE OF JOINT COMMITTEE ON DISEASES OF THE CHEST

In establishing a Joint Committee on Diseases of the Chest, the purpose of the American College of Chest Physicians and the American College of Radiology is to exchange ideas and to propose guiding principles on the problems involved in routine chest x-rays in hospitals (general, mental, etc.), and mass chest x-ray programs. The committee agrees: that each physician should be encouraged to have a chest x-ray of all of his patients; that every patient admitted to a hospital private or public, should have a routine chest x-ray; and that the follow-up for all suspected lesions seen in chest x-ray surveys should be organized very carefully to assure that the patient comes under medical supervision.

LIMITS OF SURVEY

Routine chest x-ray examinations should be defined as those examinations of the chest which are conducted to screen persons with abnormal changes of the chest from persons with normal chests. The examinations are screening diagnostic procedures and are not to be considered as clinical diagnostic examinations. The screening method is for the purpose of detecting the presence or absence of a lesion only.

The size of the film which one uses for screening purposes is not of primary importance. The committee believes in principle, however, that when microfilms have been used, a 14 x 17 inch film is a necessary second step in the screening procedure and the mechanism whereby such is provided in any community shall be determined by the local medical society or the local hospital staff. Survey chest x-rays either in hospitals or in the general population are approved as a screening device if conducted by agencies which utilize well qualified professional and technical personnel and which make sincere efforts to send the positive individuals to qualified local physicians or clinics for proper follow-up.

INTERPRETATION AND REPORT

Interpretation and reporting of medical findings is a medical matter and should bear the signature or identification of the responsible physician.

METHOD OF REPORTING

Method of reporting of chest survey studies: This is a local matter and is by prearranged agreement between the employer and the employee in industrial surveys; in other surveys it is in accord with medical ethics, according to local agreement.

TYPE OF REPORTING

Type of reporting: The Committee discourages the reporting of suspicious cases as tuberculosis. It believes this to be a clinical diagnosis. The x-ray interpreter should designate the cases that require immediate follow-up as "urgent". The small film x-ray interpretation is merely an impression.

It should be emphasized that the 14 x 17 inch film is a diagnostic aid and the results derived therefrom are also impressions and not diagnoses. Even the larger film is but one of several examinations necessary in order to establish correct diagnoses.

DOUBLE READING

The committee notes the several publications indicating the extent of false negative and false positive reports resulting from inter- and intra-individual

*Approved by Joint Committee on Chest X-ray; American College of Radiology, American College of Chest Physicians, February 4, 1953.

variations in interpretations of chest films. From these it is evident that failures to detect tuberculosis can be reduced by multiple readings, but at the expense of increasing the false positives, unless a check mechanism is employed. The simplest elaboration of multiple reading is the independent interpretation of the film by two physicians with referee conference of the two undertaken in those cases in which they disagree. Only those cases on which both agree in conference should be followed.

While such a procedure may result in the detection of a slightly larger portion of all the abnormal cases, it may not be feasible from an economic or personnel standpoint. Groups responsible for survey operations are urged by the committee to give consideration to double reading as one of the methods by which survey yields may be increased. Availability of financial resources and qualified professional personnel, as well as the need for other services of relative importance, will be determinates in this decision. The committee, therefore, calls attention to some of the virtues of double reading but does not recommend it unreservedly.

PROFESSIONAL COMPENSATION

The professional cost of performing routine chest examinations in hospitals: The Joint Committee believes the radiologist and/or chest physician should be compensated just as any other physicians practicing his profession. The procedure is time consuming and places a definite responsibility on the radiologist or chest physician. The Committee likewise felt that in this matter the basc principle of payment is by arrangement between the physician and the hospital or agency involved. In the reading of follow-up films there should also be an individual limit to the number of films which should be read in any one day by one physician and which he should not exceed. The compensation, of course, would have to take into consideration, whether the physician makes the film in addition to interpreting it.

CLOTHING OF PATIENTS

Whether or not a screening examination can be conducted with the patient fully clothed: Since the number of lesions overlooked because of clothing (2 per cent) is considerably smaller tha the normal variations of interpretation (Chamberlin, etc.) have demonstrated tc exist in the reading of photofluorographic films, it is concluded that the examination of clothed persons is as effective a procedure as examination of the undressed persons. Since examination of the fully clothed persons is an easier procedure as compared with the examination of the undressed persons, the Committee agreed that screening examination may be conducted with the patient fully clothed.

READER'S QUALIFICATIONS

Qualifications of readers in mass chest surveys: It was believed at the present time there was no practical method which could be used to evaluate the qualifications of a particular reader. Studies in this respect are being made at the present time. It is hoped that within a short period of time satisfactory testing methods will be available. The committee therefore agreed to leave this matter open for further discussion.

PROTECTION

The radiation received by all professional, technical and clerical personnel associated with photofluorographic equipment should be continuously monitored by means of film badges or other devices which have been proved to be satisfactory for determining the radiation exposure of personnel.

When an individual receives more than 100 milliroentgens per week, the medical officer in charge of the unit should immediately determine whether the individual has been careless or whether the protective devices of the equipment are at fault.

If the fault lies with the individual, the individual should be informed of the

fact and strongly cautioned regarding the dangers of excessive radiation exposure. Failure to regard such warning should be considered as negligence on the part of the individual.

If the fault lies with the equipment or protective devices, the photofluorographic unit should immediately be taken out of commission until such time that measurements of radiation conditions where technical or clerical personnel are required to work will yield radiation exposures less than 100 milliroentgens per week for case loads of 2,500 exposures at 95 kv. and 40 ma. seconds (the average exposure per photofluorographic chest film).

CONTINUATION OF STUDY

It is recommended that the Joint Committee arrangement continue and that the Joint Committee meet annually, or at the call of the co-chairmen. In an effort to have the Joint Committee act continuously and without interruption, interim ideas should be sent to the co-chairmen, and an exchange of opinion should continue during the intervals between meetings. Recommendations are solicited from all interested in the affairs of the Joint Committee.

JOINT COMMITTEE ON CHEST X-RAY

American College of Radiology

Leo G. Rigler, Minneapolis, Minnesota — Chairman
Sydney J. Hawley, Seattle, Washington
Russell H. Morgan, Baltimore, Maryland
E. P. Pendergrass, Philadelphia, Pennsylvania
Paul C. Swenson, Philadelphia, Pennsylvania

American College of Chest Physicians

Otto L. Bettag, Chicago, Illinois — Chairman
Robert J. Anderson, Washington, D. C.
Hollis E. Johnson, Nashville, Tennessee
Edward Kupka, Berkeley, California
James H. Stygall, Indianapolis, Indiana

College News Notes

Dr. Leo G. Rigler, Minneapolis, Minnesota, Professor of Radiology and Chief of the Department of Radiology of the University of Minnesota, has been appointed an associate editor of *Radiology*, official publication of the Radiological Society of North America.

Dr. Alton Ochsner, New Orleans, Louisiana, Professor of Surgery and Chairman of the Department of Surgery, of Tulane University School of Medicine spoke before the 103rd Annual Session of the Medical Association of Georgia, Savannah, Georgia, May 10-13, 1953. Dr. Ochsner's titles were "Acute Cholecystitis" and "Early Diagnosis and Treatment of Cancer of the Stomach."

Dr. Louis L. Friedman, Birmingham, Alabama, Director of the Friedman Diagnostic Clinic, presented a paper on "Pneumoconiosis in Soft Coal Workers" before the 103rd Annual Session of the Medical Association of Georgia, Savannah, Georgia, May 10-13, 1953.

Dr. Joseph S. Hiatt, Jr., McCain, North Carolina, spoke at the Annual Greensboro Academy of Medicine Symposium, Greensboro, North Carolina, March 26, 1953, on the subject "Drug Therapy in Tuberculosis."

Dr. Sydney Jacobs, New Orleans, Louisiana, Assistant Professor of Clinical Medicine, Tulane University, spoke before the 103rd Annual Session of the Medical Association of Georgia, Savannah, Georgia, May 10-13, 1953 on "What to Expect of the Photofluorogram" and "Diabetes and Tuberculosis."

Dr. William A. Hudson, Detroit, Michigan, First Vice-President of the American College of Chest Physicians, gave a talk at the Rotary Club of Harrison, Arkansas, April 2. The subject of his talk was "The Influence of Medicine in Preserving International Peace."

Dr. Antonio Rodriguez Diaz, Havana, Cuba, has recently been appointed President of the Sociedad Nacional de Cirugia for 1953-1954.

Dr. Leon Unger, Chicago, Illinois, Associate Professor of Medicine, Northwestern University Medical School, has returned from an around-the-world trip. During this time, he delivered 17 speeches before various medical societies in Hawaii, Japan, Hong Kong, Siam, Pakistan; Calcutta, New Delhi and Poona in India; Haifa and Jerusalem in Israel; and Athens, Greece. Many of these meetings were held under the auspices of the College chapters and Dr. Unger's subjects covered the various aspects of bronchial asthma and migraine.

Review

Jackson, Chevalier

GRASSES AS FOREIGN BODIES IN THE BRONCHUS AND LUNG

A very interesting article has been written by the dean of the bronchoesophagologists. Dr. Jackson has recorded his own experience and has summarized the reports in the literature concerning the various grasses which may become lodged in the bronchial tree. These foreign bodies are of particular interest and are of two types: the "lodging" type and the "perforative" type. Seven cases of the lodging type have been reported. The grass spike in these instances is usually of the timothy weed variety, and it remains in one place in the bronchial tree until removed bronchoscopically. Dr. Jackson records 28 cases of the perforative type, and in this instance the grass spike is driven through the lung and through the thoracic wall and is extruded on the dermal surface. Of particular interest is the infrequency of either empyema or pneumothorax as a complicating factor and the speed with which the patient recovers once the spike is extruded. Dr. Jackson discusses in considerable detail the various mechanisms which are responsible for the one-way trip of these perforative foreign bodies. He particularly calls attention to the ratchet-like mechanism demonstrated by these foreign bodies. He cautions against ill-advised surgical interference in the management of perforative grass spikes and points out that in general, the prognosis is good.

As is characteristic of all Dr. Jackson's writing, his presentation is scholarly. He urges that in all such cases the botanical classification of the spike or spikelet be determined and included in all future reports of grasses as foreign bodies in the tracheobronchial tree. This contribution will be of interest to all bronchoesophagologists.

Arthur M. Olsen, M.D.

Book Reviews

"*X-Ray Diagnosis of Chest Diseases*," by Coleman B. Rabin. The Williams and Wilkins Company, Baltimore, Maryland, 1952. Pp. 208. Price $12.00.

The section on diseases of the lungs by this author which is a part of Volume One of Golden's looseleaf *Diagnostic Roentgenology* has been enlarged in this new monograph. Because of the use of this material from the original volume, a most peculiar page numbering system is apparent, one with which the reader must familiarize himself to begin with, in order to make the book useful for ready reference. The organization of the material is excellent. The author gives first a section on general considerations which includes matters of technique, roentgen anatomy of the lungs, the effects of various kinds of pathological processes upon the lungs, and the manner of examination which needs to be used in these conditions. The second section devotes itself to general roentgen pathology patterned after the usual texts on pathology. A third section is devoted to regional changes, dealing specifically with various disease processes in the lungs, mediastinum, pleura and diaphragms. In a fourth section the author takes up specific types of shadows, such as nodular lesions, cavities and linear infiltrations and attempts to differentiate the various disease processes which may produce such changes. This is a valuable procedure and may be very helpful for reference purposes. The diseases of the cardiovascular system, per se, are not considered in this volume.

Since the book contains an enormous amount of material, it is difficult to criticize it in any detail. The author brings home well the fact that in the consideration of diseases of the respiratory system, roentgen examination is the major method of attack; therefore, all of the innumerable diseases which affect the respiratory system are thoroughly considered and fairly well discussed. The important clinical features are also brought out. On the whole the text is excellent, the illustrations profuse and there is little to criticize.

It is unfortunate that American publishers often find it impossible to reproduce illustrations of roentgenograms in adequate fashion. In this book, for example, the overlay of artefactual shadows in some cases almost destroys the value of the original illustration. Such defects in the reproductions are particularly unfortunate when the small details of the changes occurring in pulmonary disease are being demonstrated. In the gross lesions the pathology is adequately and effectually exhibited, but where the changes are minor, it may be difficult for the reader to see the distinctions which the author undoubtedly was able to observe in his original films. For example, in Figure 48 it is difficult to see the mediastinal hernia. In Figures 64 and 65, the distinction between pulmonary congestion and polycythemia affecting the lungs, which is a very real one, could not be made out from these illustrations. Similar difficulties are encountered where fine details are needed.

Physicians interested in diseases of the chest should be thankful that the author has seen fit to publish his section in this separated form. It is an excellent representation of diagnosis as made by the roentgen method and will be particularly valuable to chest physicians.

Leo G. Rigler, M.D.

"*The White Plague*, Tuberculosis, Man and Society," by Rene and Jean Dubos. Little, Brown and Company, Boston, 1952. Pp. 277. Price $4.00.

By reason of long experience and outstanding accomplishment in the field of bacteriology and closely related fields, the authors were especially qualified to write this book. Dr. Rene Dubos is known everywhere for the biography of *Louis Pasteur*. His many outstanding contributions in bacteriology and pathology have won numerous honorary degrees from some of the world's most famous institu-

tions, as well as the editorship of the *Journal of Experimental Medicine*, the Trudeau Medal of the National Tuberculosis Association, and currently the presidency of the Society of American Bacteriologists. Since graduating from Ohio State University, Jean Dubos has had wide experience in bacteriology in industry, in the Harvard School of Medicine and the Rockefeller Institute for Medical Research.

Those who believe that man's battle against tuberculosis is about won, will be surprised to read that in the world, every year, from three to five million people die from tuberculosis, and that some 50 million constantly suffer from the disease and transmit tubercle bacilli to others.

The first five chapters are devoted to tuberculosis in the 19th century, when the disease reached epidemic proportions in the Western World and caused as many as 30 per cent of all deaths in some places. Brief sketches are presented of the lives of famous persons such as Frederic Chopin, Henry David Thoreau, Robert Louis Stevenson and John Keats, whose work was interrupted and untimely death was caused by this disease. Tuberculosis struck down people everywhere without regard to position or status in life. Brief sketches are also presented of the lives of persons who made significant discoveries and contributions to the knowledge of this disease such as Laennec, Koch and Roentgen.

Part II is devoted to the evolution of our knowledge of the cause of tuberculosis, including the discovery of the tubercle bacillus. Treatment and prevention are presented in Part III. Various methods that have been introduced through the centuries are described and the most modern forms of treatment, including all of the newer drugs, surgical procedures, etc., are included. Emphasis is placed upon the fundamental methods that have led almost to eradication of the disease in animals and people in certain parts of the world, but where, without these methods, the disease continues to exist unabated. The fourth part of this book is devoted to tuberculosis and society.

This is one of the most fascinating and at the same time most authentic books that has ever been published on tuberculosis. It is so written that it is of true value to professional workers and at the same time can be read with profit by others. Physicians who read this book will prescribe it as a part of the treatment of their tuberculous patients.

J. Arthur Myers, M.D.

"*Tuberkulose Ablauf im Keerper*," by Reiner W. Mueller, Stuttgart, 1952, Georg Thieme (170 pages).

This is an outstanding, concise presentation of the pathomechanics of tuberculosis. In spite of the plethora of literature, past and present, in medical periodicals and in books on this subject, this volume brings out worthwhile, interesting and revealing information.

Meticulous and systematic approach to the appraisal of pathological changes is one of the chief characteristics of this work. The interpretation of reactive changes in the body which follow the invasion and spread of tubercle bacilli is portrayed in the light of the author's personal experience and it is well amplified by data recorded by earlier observers. The illustrations comprise excellent diagrams and reproductions of roentgenograms. The inclusion of pertinent colored plates enhances the value of this book. The text is printed in easily readable German. The bibliography is comprehensive and the index is good. The paper and workmanship of the book are of first-class quality. This book is highly recommended for the perusal of students, practicing physicians and research workers.

Andrew L. Banyai, M.D.

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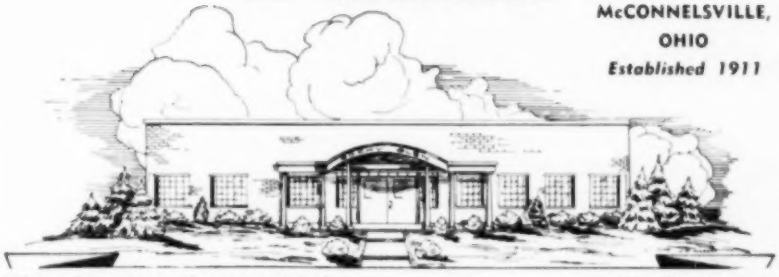

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COLLEGE EVENTS

NATIONAL AND INTERNATIONAL MEETINGS

19th Annual Meeting, American College of Chest Physicians, Hotel New Yorker, New York City, May 28-31, 1953.

Interim Session, Semi-Annual Meeting, Board of Regents, St. Louis, Missouri, November 29-30, 1953.

20th Annual Meeting, American College of Chest Physicians, San Francisco, California, June 17-20, 1954.

3rd International Congress on Diseases of the Chest, Barcelona, Spain, Fall of 1954.

POSTGRADUATE COURSES

8th Annual Postgraduate Course on Diseases of the Chest, Chicago, Illinois, September 28-October 1, 1953.

6th Annual Postgraduate Course on Diseases of the Chest, Hotel New Yorker, New York City, November 2-6, 1953.

CHAPTER MEETINGS

Minnesota Chapter Meeting, St. Paul Hotel, St. Paul, May 20, 1953.
New Jersey Chapter Meeting, Haddon Hall Hotel, Atlantic City, May 20, 1953.
New England States Chapter Meeting, Deaconess Hospital, Boston, May 20, 1953.
California Chapter Meeting, Hotel Biltmore, Los Angeles, May 27, 1953.

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Thoracic and General Surgeon, woman, M.D., M.S. Teaching, research, and practical experience. Interested in United States or foreign location. Kindly include particulars in reply. Please address all inquiries to Box 272B, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

Physician, age 48, experienced in tuberculosis, formerly Chief of Tuberculosis Service of U. S. hospital (Guam), seeks similar or staff position in United States. Please address all inquiries to Box 274B, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

Foreign physician, M.D., pathologist and bacteriologist, age 42, 18 years experience in tuberculosis, desires permanent position in tuberculosis hospital or sanatorium. Please address all inquiries to Box 276B, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

POSITIONS AVAILABLE

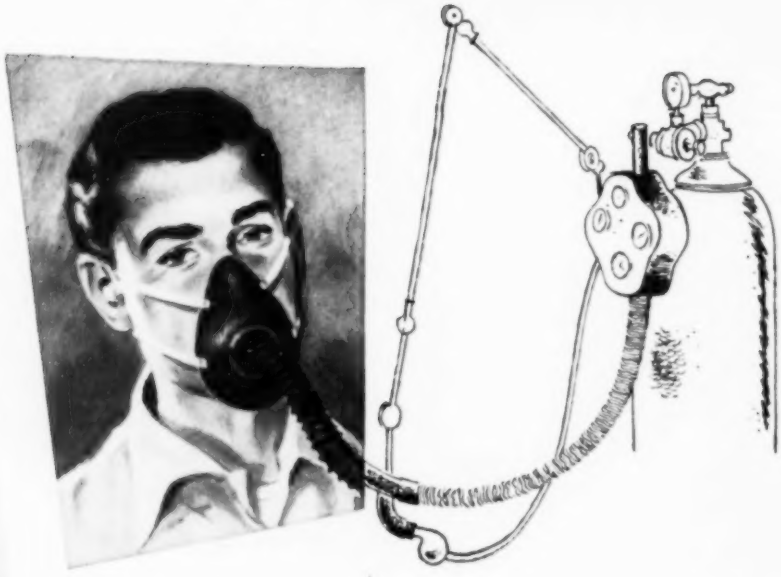
Staff physician wanted, 180 bed tuberculosis hospital. American graduate only, eligible for Michigan license. Salary $7,500 to $10,000, depending on qualifications and experience. Address Box 263A, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

Staff positions: open at state tuberculosis sanatorium in Pacific Northwest for general or special physicians. Give full qualifications, training, etc. Address Box 265A, American College of Chest Physicians, 112 East Chestnut St., Chicago 11, Ill.

Wanted—Staff Physician for approved County Tuberculosis Hospital. American citizenship and Ohio License necessary. Attractive salary. Please address all inquiries to Box 266A, American College of Chest Physicians, 112 East Chestnut Street, Chicago 11, Illinois.

Medical Director wanted. Tuberculosis experience essential. Attractive salary, modern home, hospital approved by American College of Surgeons. The hospital is Kalamazoo County owned and has 50 beds for tuberculosis, 12 beds for county convalescent cases (female only), and 19 beds for contagious cases. Make application read, Attention: Chairman, Board of Trustees, Fairmount Hospital, Kalamazoo, Michigan.

The Veterans Administration Hospital, Downey, Illinois, has several vacancies for physicians in the 297-bed tuberculosis unit of the hospital. Salaries determined by experience and qualifications: Department of Medicine and Surgery, $5,500 to $9,600 per annum. Applicants must be between ages of 21 and 54, hold degree of Doctor of Medicine from approved institution, and must have completed approved internship, as well as posess license to practice in a state or territory of the U. S., and must meet physical qualifications. Write to the Manager, Veterans Administration Hospital, Downey, Illinois.



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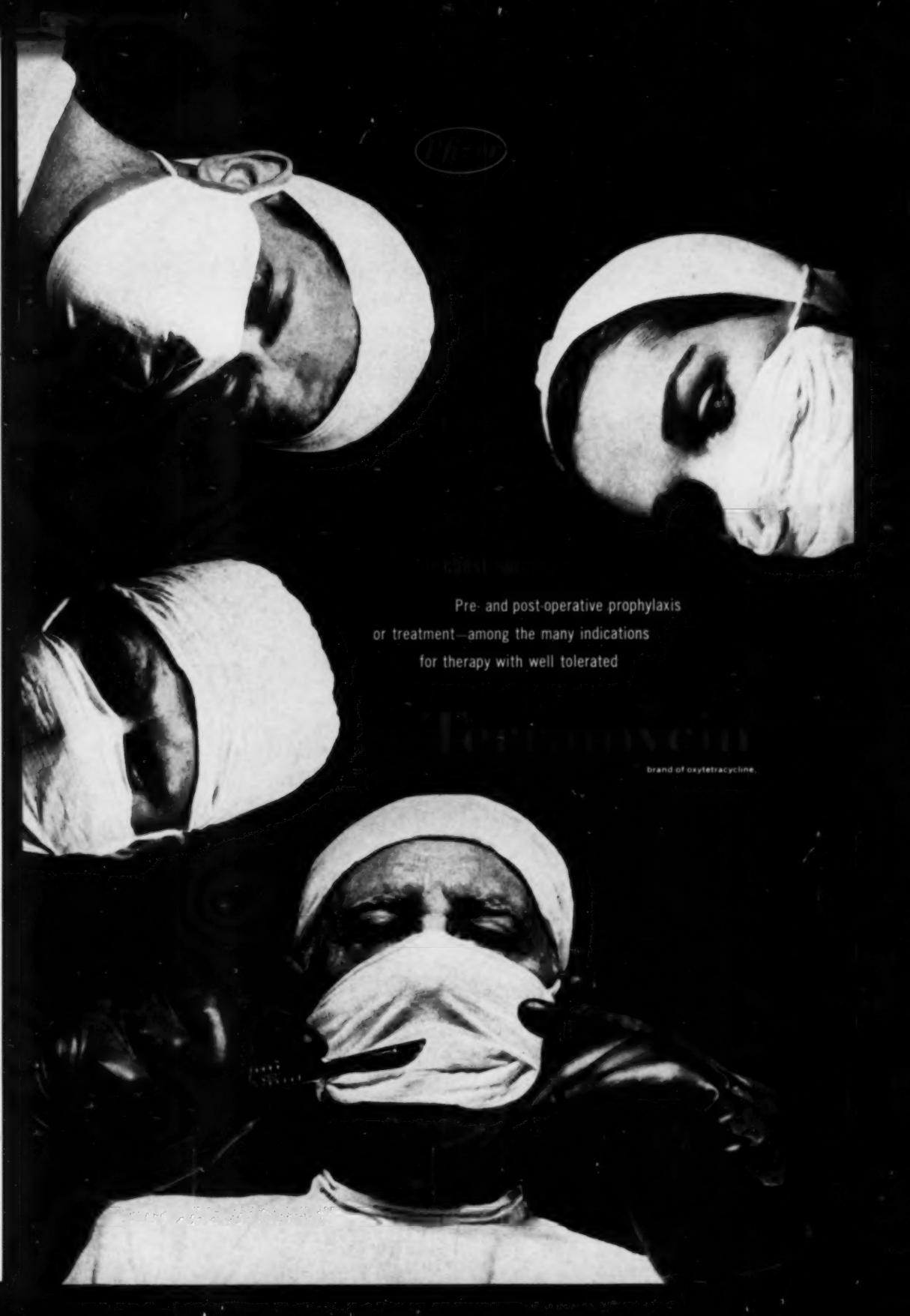
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Notes on TUBERCULOSIS CHEMOTHERAPY

May, 1953

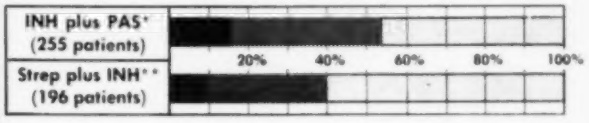
Twelfth VA-Army-Navy Conference on the Chemotherapy of Tuberculosis

In February, a 4-day conference was held in Atlanta, Georgia, attended by TB men from all parts of the country. Those present received a set of tables giving the results of various chemotherapeutic regimens as reported by 36 government hospitals. In all, 2,175 patients were treated—with isoniazid alone, isoniazid and streptomycin, isoniazid and PAS, and streptomycin plus PAS.

As was expected, isoniazid alone turned out to be not as effective as *combination therapy*. The following graphs, derived from the official report, indicate some interesting results:

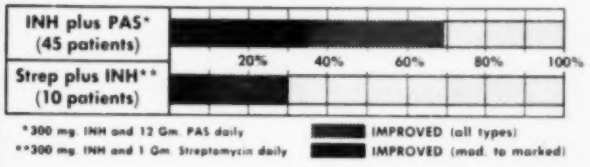
X-Ray Changes: Streptomycin-Resistant Cases

I. 2-5 MONTHS TREATMENT



When treatment is continued for more than 5 months, the results are more striking:

II. 5-10 MONTHS TREATMENT



As can be seen, the *number* of cases treated longer than 5 months is very small, and no rigorous conclusions may be drawn from the results. The data *indicates* however, that combined INH-PAS therapy may be the regimen of choice in streptomycin-resistant cases, and bear further investigation.

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